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SEPTEMBER 1925

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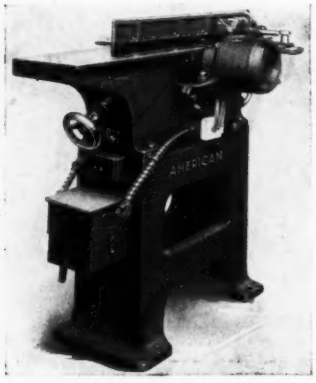

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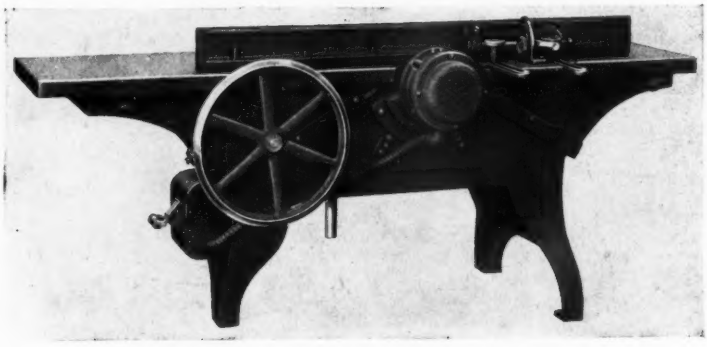

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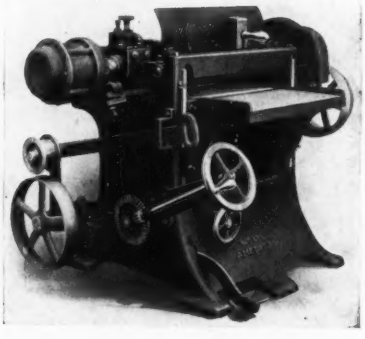

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ROCHESTER, N. Y.

Vol. XIV
No. 9

INDUSTRIAL-ARTS MAGAZINE

September, 1925

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September—
All-cheering plenty, with her flowing horn,
Led yellow Autumn, wreathed with nodding corn.—Burns.

TO SHOP TEACHERS

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Welcome back to the classroom and the shop!

Welcome back to the privilege and the opportunity of contributing a large share in the making of American men and American citizens.

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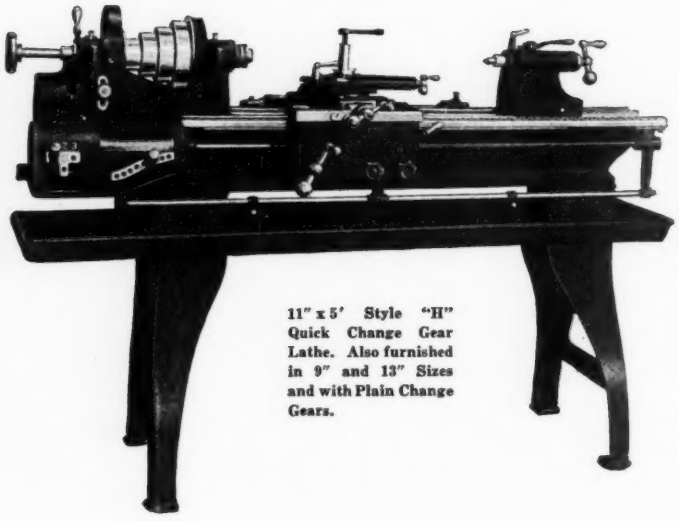

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THE INDUSTRIAL ARTS MAGAZINE

Volume XIV SEPTEMBER, 1925 No. 9

Job Sheets and Operation Sheets as Teaching Devices

Ernest C. Phillips, Professor of Shop Production,
College of Engineering, University of Missouri

THE use of written instruction sheets in teaching shop work has become so general that an examination of their form and uses may prove useful. They are prepared to make instruction clear, specific, and accurate, to give information needed to supplement directions on how to do, to economize time of pupil and instructor, to promote individual pupil progress and to give flexibility to courses of instruction.

When written instruction sheets embody specific and brief directions on doing work, and the background of information needed to make the performance of the work intelligent, they go far toward insuring economy of time and individual progress. Distinct instructional units, treated separately, may be used at pleasure, individually or in combination with other like units, and are readily adaptable to any wisely chosen series or group of jobs or projects used in shop courses. Written instructions usually represent more careful preparation than is made for oral instruction; the brief and definite directions are carefully worded that they may be understood readily and followed accurately. The instructor who prepares his teaching material in such form, has adequate time to devote to situations which arise, and each pupil has ready-to-use instruction without the delays of group or class instruction.

The nomenclature of written instruction sheets is not entirely definite. "Job Sheets," "Job Specifications," "Operations," "Operation Sheets," are terms used without close discrimination. Perhaps the term "job sheet" is more often heard than any other, since it has been used longer and has been applied to several forms of written instructions. Several writers have published series of written instruction sheets covering work in industrial arts done in the schools and instruction in trade schools and training for apprentices in some of the trades. Details covered in these sheets vary to some extent. But quite generally there is a statement of the purpose of the job sheet, a title that names the job or problem to be attempted. Then there is a schedule of the tools and materials to be employed, the procedure to be followed, heading and page reference to works published on the trade and, finally, a series of questions on the doing of the job, matters of information involved and problems raised by situations encountered. It is not the intention here to make a critical examination of the several forms of job sheets examined. They exhibit many excellent details of definite statement of problems or projects to be used, illustrations, drawings and figures, symbols and conventions employed in the trades, and other devices to acquaint pupils with usages current in the mechanical employments of men. All these are valuable aids in instruction and have their appropriate uses.

There are three important phases in teaching shopwork:

1. Telling the pupil how to do things.
2. Giving information he needs in order to do these things intelligently and with satisfaction to himself and instructor.
3. Questions designed to cause pupil to think about *why* things are done in certain ways and *why* certain things are true.

Written instruction sheets should cover these phases of instruction. Some of the published job sheets fail to meet all these simple requirements. A common fault is the *enumeration* of the steps involved in doing the job rather than *telling how to perform* these steps. Items of information are included with items of procedure in a manner that confuses, or at least does not clarify, understanding of procedures. Questions of fact, or questions involving shop or trade terms, are asked that the pupil has no available means to answer, questions that of himself he cannot answer. For example:

What is camber?
Design a hickey.
Study the diagram carefully; could the circuit be wired differently?

It is a reasonable assumption that the learner in the school shop has had, at best, a very limited experience in the branch in which he is being instructed; that he is there because he needs to be told about things; that he knows little that will guide him in performing mechanical operations. To teach such a pupil with economy of time and effort on the part of all concerned, instruction must be specific and direct; directions on how to do must be supplemented by information that gives needful facts and principles and orients the doing and relates it to mechanical work encountered in the world of affairs. Questions formulated to require the

pupil to relate facts with which he has been supplied, to the situation before him fall within the three phases of instruction referred to above; they require of the pupil processes of reasoning of which he is capable. Questions involving technical terms and the jargon of the shop, all proper and useful in their rightful place in trade shop and factory, will elicit from the pupil at best only the wildest of guesses, certainly not considered answers. The importance of making the learner understand definitely what is expected of him cannot be too strongly emphasized. Having been given a clear statement of what he is to do, he then should be told how to do it. Mere enumeration of steps is not enough. Definite instructions on how to perform each step in turn are essential. This may be illustrated by a comparison of a part of a job sheet which enumerates steps without giving specific instructions, with one covering the same part of the same job and giving clear, detailed instructions. Let it be required to center a piece of stock to be turned in an engine lathe.

ENUMERATION OF STEPS
(Conventional Job Sheet)
Centering Work

1. Find centers of cylinder.
2. Mark centers.
3. Drill and countersink centers.

Questions:

1. How may centers be prepared without combination center drill?
2. What other methods may be used to locate centers by hand?

DEFINITE INSTRUCTIONS ON EACH STEP
(Job Sheet that Tells How to do)
Centering Work

References: Smith: Advanced Machine Work: pp. 117-122.

1. Use file to remove burrs from end of cylinder.
2. Chalk ends of cylinder.
3. Apply center square to end of cylinder so that sides of square are tangent to cylinder and blade of square rests across end of cylinder.
4. Use scriber to mark fine line across end of cylinder close to blade of square.
5. Move square around cylinder until blade is approximately perpendicular to first position, and scribe another line.
6. Hold prick punch in left hand, set point on intersection of the two lines scribed, and strike head a light blow with hammer.
7. If punch mark is not exactly on lines, tip punch and drive lightly towards center until mark is on intersection. Enlarge punch mark with heavier hammer blow.
8. With left hand hold one end of stock in cup rest of drill press, and with right set combination center drill point in punch mark and apply moderate pressure to drive countersink to approximately full depth.
9. Repeat steps 3-6 on other end of stock.
10. Drill cast iron dry. Apply a few drops of oil to end of stock when drilling steel.

Questions:

1. Why should prick punch have clean, sharp point?
2. What damage may be done to lathe centers by stock drilled beyond depth of countersink?
3. What damage to lathe centers by stock in which center hole is too shallow?

Employing the enumeration-of-steps variety of job sheet naively ascribes to the pupil a knowledge of procedure equal to that of the writer of the job sheet and leaves him to blunder his way blindly through the steps listed and to guess at random what are the answers to the questions that follow the steps enumerated. The second job sheet, on the other hand, by specific instruction on each step, insures doing these steps in accordance with good shop practice and enables the doer to carry forward each step with confidence that he will reach the desired result of the work. Questions in the first job sheet raise points of procedure of which the pupil is ignorant and which he has had no opportunity to observe. Questions in the second job sheet deal with things which the pupil has in his hands, the use of tools and materials involved in doing the steps indicated. In the first case the pupil's answers will be mere guesses, while in the latter his answers will be definite because he has before him the elements needed to reason his way to valid conclusions. Job sheets of the first type are frequently met with in print today. They are not all bad, but they justify emphasis on the plea for job sheets that tell about jobs and definitely how to do all the steps in jobs.

Jobs are chosen and job sheets written after a process of breaking up a trade, or shop branch, into a series of jobs taken as typical of situations met in the practice of the trade or branch. Job sheets are used rightfully in the instruction of juveniles in industrial-arts work and in training men for specialized phases of production work in industry. In the industrial arts, the end of instruction is not to impart trade instruction or, necessarily, trade understandings. Such work is exploratory, designed to direct the observation of juveniles to mechanical appliances and mechanical work in their environment, everyday uses of mechanisms in home and in life in general, to train them to meet simple situations, to do simple jobs that frequently must be done. Such training of youth in the use and adaptation of tools and materials is not necessarily for immediate vocational ends, but it does contribute to a breadth of vision, understanding and experience needed in the education of young people to live and enjoy living in this modern world. In industrial-arts work for juveniles, the job sheet plans jobs and directs briefly how to do them, utilizing the learner's interests and inclinations. Industrial-arts instruction makes use of life situations, jobs, taken directly from the environment and activities that surround juveniles. These jobs and activities, like life itself, occur without sequence or logical order and not in accordance with well defined programs. They are not a part of single trades or vocations, capable of analysis into fundamental unit operations, nor could juveniles employ such an analysis could it be made. Their interest and enthusiasm is to get the immediate thing done and they may not be held to a program requiring them to plan procedure. The job sheet brings them the plan ready made and directs them how to perform the steps leading to the completion of the job.

Modern industry is based on quantity production, no repetitive operations performed at top speed and with high skill. The work that men do in highly organized productive industries is of very limited range and is reduced to exactly determined sequences of steps performed invariably in exactly the same manner. The skilled worker in repetitive industry finds his vocation within the compass of a few highly specialized jobs. He has no scope in his work for originality, no need for it; no occasion for analysis or planning of jobs. The modern industrial plant maintains a staff of engineers and technical experts whose office it is to design the product and to determine production procedures that will insure getting it out with utmost economy of time.

labor, and material. There is no place in this scheme for the worker who thinks. He is a doer and paid to do unquestioningly what he is employed to do. His employer wishes him trained to exact habits and high skills, so that he becomes almost machine-like in rapidity and certainty with which he works. In the training of men for such work, the job sheet finds a large use.

If we examine the jobs done by the average mechanic in the skilled trades, we are led to the discovery that, while he is called upon to do a great number and variety of different jobs, these jobs are made up of a few fundamental procedures capable of combination into a large number of jobs. Acting upon this observation, we proceed to list all the important items of trade procedure, the things that the proficient worker in the trade must be *able to do;* and we give to these procedures the name "unit operations". Unit operations are procedures that require skill in their performance, that occur frequently in the trade and that involve practically the same steps wherever found. As a rule they involve tool operations, but they may consist of established practices in assembly of materials to secure definite results. We call this list of unit operations the "analysis of the trade," using the term "analysis" advisedly within the limitations already stated.

In any trade it is observed that there are many things which the skilled mechanic needs to *know,* a background of information that will relate mechanical work to the things done in the trade, the applications of mathematics and the physical sciences to the trade. This body of information is an indispensable adjunct to the skill element in his work. Hence, we include in the trade analysis a list of what we call "information topics." The complete analysis of a trade comprehends both the doing and the related knowledge. Operation sheets and information sheets, then, constitute another important device for teaching men how to perform skilled work.

The elements of an operation sheet are: *Title*, setting forth the thing to be done; references to standard works; *directions* on how to do the steps involved in the operation, written simply, phrased concisely. The operation sheet ends with *questions,* also stated briefly and directly, intended to compel the learner to think constructively through the steps of the operation, to enable him to see why the operation is performed in a certain way, to guide him in his reading of references and to fix in his mind ideals of skill and trade practice.

It should be understood that the operation sheet is not a lesson sheet or an exercise. Operations are chosen, primarily, as *convenient units of instruction.* As instructional units they are capable of varied use. Operations are integral procedures in numerous jobs encountered in the trade, and operation sheets are employed by the learner in *learning things* rather than in *making things.* Operation sheets may be described as devices to secure *uniform right performance in practice work* and so to establish right habits leading to trade skills.

The use of operation sheets in teaching is in this wise: When a job is assigned to a pupil, he runs over his Trade Analysis and checks the operations involved in the job. This is called *analyzing* the job. He then arranges these operations in the sequence in which he proposes to perform them, and this is called *planning the job.* The pupil then selects from the list of Information Topics those information sheets which contain the related information he needs, instruction on how to solve problems involved in the job, and other applications of mathematics and science to the job. It should be observed that up to this point, in the doing of the job, the pupil has acted on his own initiative, independently of the teacher. The instructor now looks over the analysis and the plan of the job, makes needed suggestions and, in the end, checks and approves both before the pupil proceeds farther. The pupil has had at his disposal a clean cut, reasonable analysis of the trade into its fundamental procedures, his reading over the procedures listed in the analysis has directed his attention to many procedures which he would not otherwise think about. Operation and information sheets selected and approved, he is now ready to study a ready-made manual of the job in hand. He has used a minimum amount of the instructor's time and he has before him the best results of the instructor's thought and teaching effort. Frequently the teacher must be called to interpret and explain, but written instructions in which simplicity and clearness have been prime aims, need a minimum amount of explanation.

It is now possible to make essential comparisons of job sheets with operation sheets. The job sheet is written on one of the numerous jobs into which the trade is broken up. It enumerates the steps involved in doing the job, telling how to do them. The job sheet presents the pupil with a job to do and lays down the exact procedures in doing it. The pupil follows these directions with a minimum of thought about the trade as a whole or the relation of the job to the trade. On the other hand, the pupil who is given a job to do and is required to break up that job into fundamental operations common to that job and numerous other jobs in the trade, is required to bring to bear on the job and its performance discriminating thought about the job, as apart from, and contrasted with, other jobs. Having determined the operations involved in doing the job, next he is required to determine the sequence in which they may be performed most effectively. He has had to consider the things done in the trade and to select from them the things that enter into the job of the moment. Then he has had to arrange the doing of these things in a constructive sequence. In doing a job by the aid of a job sheet, he needed only to follow faithfully a path marked out by someone else. In breaking up the job into fundamental operations carefully selected from the group of operations performed in the trade and in arranging these operations in a considered sequence, he has had to bring into play independent reasoning, to

compare alternative procedures and sequences. He has had to analyze his job and to plan how to do it, to think and reason constructively through it, mental procedures that represent the highest phases of the educative process. Use of job sheets as teaching devices tends to produce the unquestioning follower, the *skilled worker* of repetitive industry. Use of the trade analysis with its operation and information sheets, on the other hand, is a constant challenge to independent thought, a mental stimulus calculated to develop the resourcefulness always associated with the *thinking mechanic*. In his book on "How to Teach a Trade," Professor Selvidge has laid special emphasis on the distinction between the skilled worker and the skilled mechanic; the one is the specialized worker in quantity production industry, the other the master of a complete trade, capable of handling independently situations that arise in the trade. One is an unquestioned follower along beaten paths, the other is the resourceful man who can follow the established way or blaze new trails with equal facility and certainty. The former, by training and habit is not a bearer of responsibility, while responsibility for accurate analysis and planning of important work is a part of the regular routine of the latter's work. The analysis of a trade into its fundamental operations and the preparation of operation and information sheets are designed specifically to train the thinking, *skilled mechanic*. From the moment he enters the shop for training, he is required to analyze and plan jobs, to compute capacities of machines, to estimate materials and costs of production, to put himself into situations identical with those observed in the trades. Employed in this fashion, trade analysis and operation sheets are a constant stimulus to independent thought and action. It has been interesting to compare the performance of classes taught by this method with that of classes following the job sheet method, to observe the confidence with which work is approached, the enthusiasm with which it is carried to completion, the marked improvement in quantity and quality of work done.

Where job sheets are employed which are written with clearness and fidelity to detail, they leave nothing to the chance that the pupil may happen to know how to do what he is told to do or that he will happen to do it right. In all shop teaching it is highly important that right procedures, right methods, be employed. If we are teaching manual arts to juveniles, it is as easy to teach them to follow good shop practice as to allow them to do shop work in a slipshod, slovenly way. If we employ job sheets to train men to perform highly specialized tasks in accordance with exacting requirements, we accomplish this result through the same agency of specific, detailed instruction in every step of every job.

To summarize the comparison of job sheets and operation sheets as teaching devices:

They are alike in that each includes specific, simply and carefully worded directions on how to do each of the steps involved in the job.

Their unlikenesses are that:

1. The job sheet analyzes and plans the procedure in its entirety and is, for that reason, the better device for instruction of juveniles and the skilled workers who work in, and under the conditions of, the repetitive industries.

2. Use of the job sheet trains the learner to be an unquestioning follower, the *skilled worker* of repetitive industry. It gets things done but does not train the doer to be an originator or a planner.

3. The operation sheet requires the learner to analyze the job and to plan its performance, bringing into play on each job done the highest processes of thought and reason.

4. Use of trade analysis, operation and information sheets trains the learner to be the *skilled mechanic*, the independent, resourceful planner and doer.

It should not be assumed that job and operation sheets that comply with the exacting standards stated here are available for general use in shop teaching, or that their use, if available, necessarily would be an easy and simple matter. While this discussion might imply that they are simple and their preparation easy, the experience of those who have developed them and applied them over a term of years is quite to the contrary. Teachers who have applied this method to their work have found the task an arduous one, have discovered that their previous thought was far from clear and that their effort to put down in simple, unequivocal English definite instructions on how to perform the operations involved in their shop teaching necessitated, in its successful performance, extremely close application and long continued, earnest effort. There is no easy, wholesale method of securing job sheets or operation sheets wherewith to teach shopwork. Nor can teacher B expect to adopt teacher A's material in toto and to use it with entire success. If A's material is good and its use effective, it is because A has brought into it the best of A's inspiration as a teacher, A's humanity, A's professional idealism, A's passion for accuracy and honesty in teaching effort. If B would achieve A's results, B must work as A worked, discover the secret of A's success, as did A, through laborious patient effort. The man who successfully *uses* job and operation sheets in his teaching is the man who has *learned how to write job sheets and operation sheets* that measure up to the exacting requirements here described.

Job sheets and operation sheets are not educational panaceas, do not necessarily "make teaching easy". They are valuable devices in instruction only when they are rightly employed. Which is another way of saying that in the teaching process they constitute another of the tools of instruction and that this tool will prove ineffective unless wisely used. Written instruction sheets do not relieve the instructor from the necessity of teaching. Rather do they shift the emphasis in teaching. They relieve him from much of the drudgery of detailed oral instruction and give him the status with his class

of foreman or manager of a group of independent workers, administrator as well as monitor, with more adequate time to observe equipment and order its repair and right maintenance, more time to devote to the need of each pupil at the moment the need becomes apparent. He takes on the function of production man who is alert to keep each machine and worker working to capacity. Pupils will not read and heed operation or job sheets until they are taught how to do it, and here, again, the man who writes operation sheets is the man who can teach others how to use them. These devices are valuable aids in teaching, but, just as they make possible better and more effective teaching, they call for superior teaching ability and experience.

Some Types of Teachers I Have Seen

By a Supervisor.

IT IS often profitable to look into a mirror. Here are some reflections. Perhaps some of them may be familiar.

The following are a few familiar types I have seen. Later on more will be presented including some of the good kind.

1. The Office Holder

This type of instructor is becoming all too common and the fault "lies not with the teachers alone, but comes from a higher source"—the officials, who provide nice cozy, secluded offices for them. In planning a school shop I would never partition off a sound-proof, air-tight niche for the secluded privacy of an instructor or a department head. These department heads, all head and no feet, judging by the fact that they rarely venture forth from their sanctuary but are content to reign from the sacred precincts of their offices. Such instructors and heads need the power of a draft to pry them out for service on the firing lines. No danger to them, however, for the door is kept closed against the possibility of a draft. How often you see such situations. Pupils knock for admission crying for assistance.

Such instructors, save the mark, such "employees", have no place in a school. They get paid for teaching, but I'll stump you to catch them at it. Before the cross word puzzle craze, I often wondered what they did find to keep them awake. Of course they have assistants and helpers who keep the shop going. But think of the situation. The highest paid, most expert, and best trained men cooped up in a shop office doing most anything but teaching their classes.

I'll admit that teachers should have a place for their papers and for study—when the class is not in session. A common office might be provided. A desk right out in the room or shop is a very good plan.

2. The Office Seeker and Buzzer

It may be from curiosity. It may be from a "be-in-evidence" complex or perhaps because of an attractive clerk that this type of teacher is constantly in the office. They always need something in a hurry or must show something or must return something. They insult the intelligence of the office staff by writing requisitions or reports, then personally conducting them to the office and reading them to whoever will listen. This type is usually called to the telephone several times a day until rules barring telephone calls are necessary. Their classes are conducted by the "absent treatment" method, evidently—long distance instruction. This type is closely related to the "buzzer" type. The buzzer you know puts in six hard hours gossiping with other buzzers. They are seen standing in the shop doorway with one eye on the class and both ears tuned in on the latest "he saïds" and "she saids". Both types belong to the pest family but not in the teaching fraternity.

3. The Loud Speaker

No wonder his shop is disturbing to the whole school. Everything is noisy. Even the machines seem to make an unusual clatter. The boys are loud but above all the din the loud speaking instructor yells and shouts. He calls across the room to direct a boy in trouble or to bawl directions to another. He yells when giving class instruction. He bellows at faults. The boys must have nerves of steel to stand his terrible voice. "Keep quiet" he often yells at the top of his voice. The boys wonder who he means for he is surely the noisiest one in the room himself. How can such a teacher blame his boys for yelling at him? He needs voice culture. He ought to realize that most of his disciplinary troubles are due to his loud speaking habits.

4. The Chesterfield Type

Some shop teachers remind me of the saying "all dressed up and no place to go". Teaching auto-mechanics, bricklaying, machine work, or any other shop work in their "Sunday-go-to-meeting" attire. Such attire looks out of place and is out of place. It is impossible for them to get right down to a real demonstration. They can't, on account of their attire, give the boys an opportunity to see a real craftsman at work. Neatness is very desirable, even white collars and shined shoes, but every shop instructor should wear overalls or a shop coat to protect his clothes and to enable him to "give the boys a hand", naturally, as a mechanic would do it. It is a bad example for the boys in a shop. The boys should dress for their work but will they be likely to do so if the instructor does not? Wearing a suitable shop garb is nothing to be ashamed of. On the contrary, it is a sign of good sense. When I see teachers of the "Chesterfield" type attempting to teach shop work in their "smart" attire I wonder just how smart they are.

5. The Bell Hop

This is a familiar type. They hop when the dismissal bell rings. They always catch the one-minute-past-four car. They have a hat rack near the door so they won't be delayed on the way out. The class marches

out after the teacher. Popular, too, with the pupils because no one ever has to stay after school. Their clocks are likely to be a bit fast. Some neighbors set their clocks by them when they see them pass along after school. They generally get in on time too. Never before.

This type never has to plan work after school. Never has to rearrange their shop or clear up. No need for a visit to the principal. They do all such things during the day while the boys are "at work". Isn't it fortunate that the boys are often "at work" in school shops? It gives the "teachers" so much time to attend to their own personal affairs.

6. The Bally-hoo

Most of you have seen the bally-hoo artist of the circus. Some of you may recognize the type in schools. Standing before his class with his story well learned he glibly presents the mysteries of the day's lesson. It may be a new project he is going to ask them to make. Twenty minutes of talk. You do this, then that, then this, then thus and so. Never a pause, never a question, just lecturing away for dear life. At the end you wait to hear him say—"Step up, now boys, all this is yours for just one thin dime."

7. The Gracious Host

Every supervisor knows this type. The moment a supervisor enters the shop he immediately stops teaching and devotes his time exclusively to entertaining the official visitor. Of course we often suggest that we would like to see the class in action but the host assumes you don't include him. What a blessing paper is to this type of classroom instructor. They always have a written lesson to keep the children busy. The shop projects most of which you have seen four and twenty times, must be solemnly exclaimed over. My—all the fine things these teachers do when you are not around. They tell you all about it. I certainly wish I could see them at it once in a while. They often get by for you simply can't mark their teaching ability.

8. The "Superior" Teacher

This type is superior that they can't be "mussed up" by mixing with the class and doing shop work. They are the type now becoming numerous among shop men who are "getting a degree". Many of them are rapidly being educated away from shop teaching. They have a penchant for courses in about everything but courses which function when teaching a trade. Such courses are not professional improvement. These men become star gazers. They are over-cultured. They crave association with the Ph. D.'s upstairs with whom they try to discuss the "high-brow" stuff which they are absorbing. How many really good machinists, carpenters, and pattern makers are being "spoiled" by over-indulgence in purely academic courses which are making them too "superior" to even admit they are craftsmen to say nothing of teaching the trade.

It has always been noticeable how many men from the trade when entering into school work will sidestep productive shop work and turn to technical subjects.

By all this I do not mean that courses for shop men are not desirable. They are, so long as the men confine themselves to making up deficiencies and to building up their teaching and trade ability. Professional improvement up to a certain point is very necessary. Real professional improvement, though, aims to make a machinist a better machinist or a doctor a better doctor. When shop teachers lose sight of that principle and begin to seek degrees for the sake of degrees alone their usefulness as shop teachers is about over.

The Project Method of Teaching Industrial Arts Work[1]

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DURING recent years we have heard considerable criticism of industrial arts work—not criticism so much with reference to the value of the subject, but criticism more particularly with reference to the form of of teaching. It has been said that the work has been too formal in its organization, that too much emphasis has been placed upon teaching tool processes rather than teaching boys. As a result of this criticism, a reaction has taken place with reference to this so-called formal type of instruction.

Critics have said that many of the industrial-arts courses in the schools of today, differ but little in the matter of formal instruction given from the manual training courses of forty years ago, which was based upon the Russian system of tool instruction. It is true, of course, that finished projects have been substituted for abstract exercises; nevertheless, one finds that many of the industrial-arts courses of today are very formal, in that they so strongly emphasize logical sequence of tool processes. To state it another way, critics say that subject matter has been emphasized instead of giving the child first consideration.

It is in connection with this criticism of the emphasis upon the formal values in industrial arts work that I have chosen to discuss the project method of teaching, through which it is planned to teach boys and girls rather than processes and books.

Origin of Term "Project"

The term "project" as used in connection with a notion, concept, or method of teaching is a late arrival in educational terminology. It is an old word used in a new way to express a valid notion or concept.

It is generally recognized that the term "project" as an educational term, is limited to the present century. Stevenson states that "it was first employed in agricultural education by R. W. Stimpson, who used the expression "home project" in the agricultural depart-

[1]This article is based on a paper read before the Manual Arts Section of The Illinois High School Conference, November, 1924.

ment of the Massachusetts vocational schools. In 1908-1910 the unmodified word "project" was used by Stimpson, Snedden, Prosser, and Allen in their report to the Massachusetts legislature. Since its use in Massachusetts the term with many variations in meaning has been applied to many of the subjects of the course of study."[2]

The term "project," we are told, was borrowed by secondary school teachers of science and manual arts from the field of agriculture. It has been extended as a unit of instruction to all types of school work, particular emphasis at this time being placed on it as a method or device for teaching academic subjects.

Definition

Educators of authority who have made a study of the project method of instruction differ somewhat when they attempt to define this new idea in education. Snedden defined "project" as "a word used to describe a unit of educative work in which the most prominent feature was some form of positive and concrete achievement." This definition of "project" is not quite in accordance with later definitions.

Branon defines "project" as "an intellectualized, purposeful unit of activity." Stevenson says "the project is a problematic act carried to completion in its natural setting."[2] Kilpatrick defines "project" as "a whole-hearted, purposeful activity proceeding in a social environment."

In analyzing these definitions of "project" we find several common elements which might be used to make up a composite definition. 1. A project is an intellectualized, whole-hearted, purposeful unit of work or activity. 2. That it proceeds in a social environment or natural setting; that is, it is a life problem solved not as one would solve it as a school problem only, but as a real life problem. 3. To be a project it must be carried to completion.

Putting together these common elements we might define "project" as an intellectualized, whole-hearted, purposeful unit of activity proceeding to completion in a social environment or natural setting.

Illustration of a Project

Kilpatrick offers the following as an instance of a typical project which, for our purpose of discussion, I would like for you to consider as an out-of-school activity. He says, "Suppose a girl makes a dress. If she did in hearty fashion purpose to make a dress, if she planned it, if she made it herself, then it would be an instance of a typical project. We have a whole-hearted purposeful act, carried on amid social surroundings. That the dressmaking was purposeful is clear; the purpose once formed dominated each succeeding step and gave unity to the whole. That the girl was whole-hearted in the work is assured in the illustration. That the activity proceeded in a social environment is clear; other girls at least are to see the dress."[3] The important point is, first, it was a purposeful act, and second, that it was carried out as a real life problem to completion.

Let us take as another illustration, the independent activity of boys in their out-of-school work in making a radio set. To begin with, the boy has a purpose which is the first essential in the project method of teaching. He wants a radio set. To make one that will work means more than just the manipulation of tools and materials. He does not go very far with his problem until he finds it necessary to do some real studying in order to make a set that will work. He reads articles on the construction of radio sets in magazines and newspapers. He must acquire some of the fundamentals of electricity. He visits supply stores, etc. If things do not work for him at once, he is not told by a teacher how to solve his problem. It is with him a matter of research. In other words, he teaches himself. He uses his own initiative, and finally when he succeeds he surprises us with reference to the fund of knowledge he has acquired. I think we shall all agree that the boy through his own efforts learned, no doubt, more in making his radio set unaided than he might have learned under a teacher teaching according to conventional schoolroom procedure.

As another illustration I cite the out-of-school activity of a boy's first experience in wiring a house for a door bell. To begin with as in the case of each of the other illustrations he has a purpose, the first essential in the project method. We may assume that he has but little knowledge of electricity, and its application in wiring for a door bell, but he has a desire, a purpose in mind. After this first step, his next step is to plan. He is now confronted with a situation. How is he to proceed? He does not proceed according to a plan or organization of another. He works toward a conclusion which may be far distant. It now becomes a problem of research for him. He works toward definitions and principles rather than from them. He becomes a real scientist. He reads books and magazines, including perhaps articles on how to wire a house for a door bell. He continues his research until he thinks he knows how to proceed to wire a house for bells.

His next step is to execute his plans. In this step he may find that his plans do not work and further research is necessary. In the fourth and last step his judgment is exercised in determining results. I have given three illustrations taken from boys' and girls' out-of-school activities to illustrate the idea of project as a unit of instruction in which there is a whole-hearted, purposeful act carried out amid social surroundings. By social surroundings is meant that they are all real life problems. Professor John F. Woodhull says "that the method is one merely of research adapted to the age and capacity of the individual." He says, "the great masters of science, Galileo, Faraday, Pasteur, and others illustrated in all their lives and work the project method. The intelligent man illustrates it in all his work outside of the field of education. High school pupils use the project method in all their self-directed work outside of school. But when the schoolmaster undertakes to direct the pursuit of knowledge he formalizes, he systematizes, he schematizes, and invariably inverts the natural order of learning. The result is that our young people are getting their real science through various outside agencies.[4]

Modern educators, sensing the real situation, are endeavoring to use the project as the unit of instruction in developing a new method, called the project method. It is an attempt to bridge over the chasm between school and life, to get boys and girls to work out projects in school as the boys and girls did in their out-of-school activities in the instances given.

Many of the so-called projects as we find them taught in the schools are mere exercises in execution, in which there is no real, purposeful act and in the completion of which the teacher does the planning, furnishes

[2]Stevenson, J. A.—Project Method of Teaching. Pp. 40-41.

[3]Kilpatrick, W. H.—The Project Method. Teachers College Record. Vol. 19, No. 4, September, 1918; p. 320.

[4]Woodhull, J. F.—The Teaching of Science, p. 233. (Macmillan.)

all the information, and the whole process results only in the acquisition of new skill and experience in practical manipulation.

A project is not necessarily something done with the hands. It has been defined as a whole-hearted, purposeful act carried out amid social surroundings. A project, we are told, is an intellectualized, purposeful unit of activity. This means that in teaching by the project method, that the main emphasis must be placed on educational values rather than on different skills and facts.

Aims and Purposes

As to the aims and purposes the following might be cited as those most commonly given.

1. To develop the thinking powers.
2. To develop judgment through the child's purposeful effort and initiative.
3. To teach the child to take some steps not dictated by the teacher, in other words, to teach initiative.
4. To teach him to have a sense of responsibility.
5. To lead him to a fuller enjoyment of his work.

We might add that it aims to do more than develop skill in manipulation.

The tendency of children in school is to do no more than they are assigned. It has been said that "they tend to become like wheel-barrows, just going as far as one pushes them and no further." This is dangerous. The project method is a reaction against the pushing process in teaching, and is intended to avoid the dangers referred to by getting the child to work like a scientist, to use his own initiative and take the lead rather than be pushed."

Parenthetically I might say that making projects, and teaching by the project method, are not the same thing according to the advocates of the project method. A teacher who has his pupils make projects, wherein there is no purposeful act on the part of the pupil, and in the making of which the teacher does the planning, being very careful to tell the pupil what step to take next is not teaching by the project method, but is merely teaching manipulation or emphasizing form, technic, and skill.

As stated before, the project method of teaching is intended to bridge the chasm between school tasks and activities outside of school. The project idea presents problems. By this method the situation is so set that the solution of these problems is not essentially different from those of life, and the aim is to carry the solution to completion. The idea is to get away from abstract teaching and to give the work a real life motive, to give the problem a natural setting.

To revert again to my illustration of the boys' out-of-school activity in wiring up a house for bells you will recall there were four steps in the process characteristic of the project method when used in the schoolroom; namely, first, purpose, second, plan, third, execution, and fourth, judgment.

What did the boy gain in his project in wiring for electric bells? At least three things: First, he learned to take some steps not dictated by a teacher, in other words, he developed initiative; second, he developed a sense of responsibility, and third, he obtained a fuller enjoyment of his work than he would have had he been directed just what to do by a teacher. He has met the difficulties, achieved success, and has a right to feel proud of it. He reversed the prevailing school procedure and followed the natural method of scientific workers.

I have taken boys' and girls' out-of-school activities to illustrate my idea of the project method as a purposeful act carried on under life conditions. The emphasis as to values in each case is not placed upon a concrete objective achievement, or upon a complex problem as such, but upon a unit of work involving a whole-hearted, purposeful activity resulting in educational values of an intellectual kind.

The purpose of the project method of teaching is to get pupils to purpose and work out projects in the schoolroom as the boys and girls referred to did in their out-of-school activities.

In the industrial-arts field the aim is to give boys an opportunity to use their constructive instincts and capacities, and in this way to develop habits of planning to meet their own needs. This will aid in making the boy more independent and handy in doing things he otherwise would not do.

Briggs states that one of the purposes of education in the junior high school is, "To teach pupils to do better those desirable activities that they will do anyway, and to teach these by means of material in itself worth while."[5] He recognizes in this statement the purposeful activities of pupils in their out-of-school work in life and the importance of making these activities the basis of school instruction. He says in substance that one of the aims of school work is to develop purposes as well as to acquire facts and skills, and that it is the teacher's duty to develop worthy purposes along with facts and skills, and at the same time assist the pupil in developing his creative ability. If a pupil studies at all it will be because of a purpose. If the teacher can get the pupil to initiate, plan, construct, and criticize his project without compulsion, he has raised the moral and intellectual level of the child.

We are told that "The newer project-teaching merely plans to substitute a project based on information which the pupil may be led to desire for himself, rather than upon information which the pupil feels he needs only to escape the teacher's censure. If ever a topic can be found that bears no relation whatsoever to 'those worthy things our pupils do anyway' then we have the strongest possible grounds," Kilpatrick says, "for its total rejection as not being 'material in itself worthwhile.' "[6]

Method

In the application of the project method of teaching we must face such questions as the duties of the teacher, the determination of projects, and matters relating to the teaching of designs, shop drawings, tool processes, and methods of construction.

First Step

As to method it is the teacher's duty to guide, suggest, and inspire, but not, we are told, to do much directing. The teacher should think up a list of good projects and present them to the child, but not insist that he take any of them if the child can think up something better.

Some boys will have definite ideas in mind, others will need suggestions. At a previous period the boys are told that they will be permitted to make projects which they would like to make and for which they have a need. The attention of the boys may be called to photographs and blue prints of many things which boys can make. Books, catalogs, magazines containing suggestive problems and projects completed by other boys may be used as suggestions.

[5] Briggs, T. H.—General Aim of Speyer School.
[6] Van Denberg—"The Junior High School Idea," p. 242.

The pupil must be made to realize that the project selected must be such that it can be completed within a reasonable time, and that there is available equipment, sufficient for its execution, and the teachers must see to it that any choice made is within the pupil's constructive ability.

With the help of the pupils the teacher makes up lists of possible projects. From these the pupil selects. A good way to provoke thought upon the part of the boys and get them interested in what they are going to do is to have each boy discuss his choice before the class and tell why he wants to make it, and what he knows about how to make it.

It is quite evident that if industrial-arts teachers are to provide sufficient opportunity through thought-provoking problems for the exercise of boyish constructive tendencies along lines of natural interest, that a variety of activities is necessary. If the thought-provoking project is to be used as the best educational unit of instruction, it is quite evident that the child cannot realize his most pressing needs in a shop equipped for woodworking only. As stated before, simply making projects as we so often find it done in the conventional woodworking shop, and teaching by the project method are two different things. The opportunity to make projects which are thought-provoking and which satisfy real needs of the boys have far greater educational value than the formal manual training projects. It is quite evident that if the project is to be used as the unit of instruction, it cannot be limited to one material. This suggests the importance of a general shop equipment in preference to an individual shop equipment in teaching by the project method.

The general shop has been referred to as an important factor in teaching by the project method, and to indicate the fact that if a boy is to initiate his own project, he cannot in all cases be limited to one material. However, there is no reason why the project method cannot be used where one activity only is represented.

Second Step

In the second step, that of planning, it becomes the teacher's duty to see that the pupil has access to necessary information. He should impress upon the pupils the importance of a plan of what they are going to make or do. By making a plan and discussing it before the teacher and other boys, it will cause the pupil to think about the problems involved in his project.

A plan should include a written description, a sketch or rough drawing to begin with, and finally an accurate and fully diversified drawing. Materials, cost, construction, and tools should be considered by the pupil in planning.

It is not expected that a pupil will in all cases make a plan entirely independent of any instruction upon the part of the teacher.

In some cases a boy might succeed fairly well without instruction, but to expect a pupil to make an efficient plan without any instruction, and having no background of experience would mean a waste of the pupil's time and would most likely result in a loss of interest.

It will be necessary for the teacher to devote previous class periods to instructing the boys how to proceed in making their plans, how to make sketches, and drawings. A separate period should be devoted to making out sample bills of materials. Neither will boys be able to make a complete list of tools to be used. The problem of the teacher is to get each boy to use his initiative as far as possible in making his plans without wasting time and to place responsibility upon the boy.

Third Step

In taking the third step, that of execution, it will be necessary for the boy to constantly refer to his plans. Attention here must be given to stock and materials required, tools, tool operations, assembling of parts, fastenings, etc. At this point it is important that the teacher ask questions to find out whether the boy has made the proper preparation and is ready to construct his project.

Assuming that a boy is now ready to make his project, should he follow the trial-and-error method in learning tool processes and manipulations? Some teachers advise that pupils consult with each other and the teacher about the best methods to use. There are, no doubt, many instances where boys will make fair progress in tool manipulation when thrown upon their own initiative, but in all such cases it is generally agreed that any progress will be due to some past experience in the use of tools.

Occasionally the trial-and-error method might be used, but the teacher must always be near at hand to stimulate and to give instruction when necessary.

Our best pedagogy teaches us that before one can create he must have a background of experience. Instruction precedes creative thinking; boys must be instructed in the conventional order of procedure, if we expect to develop creative effort. On the other hand, instruction in the conventional method of procedure is of slight value unless based upon a feeling of real need.

To illustrate more clearly my idea of the need of instruction in conventional processes, in connection with the project method of teaching rather than teach by the trial-and-error method, I cite the case of two boys in high school who had for their project the designing of a drill involving the use of gears in its construction. These boys had received some instruction in drawing, but no instruction in drawing gears. The boys understood their responsibility with reference to using their initiative in designing the drill. They exhibited great interest. They studied their problem, read up on points on which they thought they needed information, and proceeded to design a drill. They made good progress in designing certain parts of the drill because they had a background of experience in certain phases of drawing, but as stated before they had had no experience in drawing gears, and when they came to this part in their problem they went to their instructor and frankly admitted that they were stuck, that they could proceed no farther. Did the instructor say, "This is your problem. You must work it out on your own initiative"? On the contrary he impressed upon them the need at this point of instruction in drawing and designing gears. The boys saw the need. The work on the drill was laid aside temporarily and some time was devoted to the conventional methods of drawing gears and the designs of same, but not the drawing of the particular gears to be used on the drill. After the boys had received their instruction on drawing gears they proceeded to carry through their project problem, the drill, to completion.

The fundamental principles of the learning process plainly indicates that rapid progress is made only when it is based upon instruction in the conventional order of procedure, that is instruction in form and technic must precede the development of creative ability or be given parallel with it. To expect the boy to work out his project problem, without instruction in the conventional order of procedure, is to me a waste of the boy's time. Instruction in tool technic should be given

either preliminary to the execution of a project or parallel with it. There must be a place to teach the conventional tool processes even though we teach by the project method.

In teaching by the project method, it is assumed that there is a whole-hearted, purposeful act on the part of the boy. He makes something he wants and sees a real need for. He really thinks and actually plans what he wants to make and how he is going to make it.

Because of the fact that it is a whole-hearted, purposeful act he will go about it with greater zeal and interest. This will cause him to overcome obstacles which otherwise would appear unsurmountable if the project were taught by the conventional methods of teaching.

To use a homely illustration, a boy who has seen a rabbit go into a hole will dig with greater zeal and interest than a boy who is set to work to find out whether or not there is a rabbit in the hole.

The boy will make better plans, he will see the need of more accurate measurements, make better shop drawings, see the need of using tools correctly and appreciate good construction. These things will follow when he sees a need for them. From this we may conclude that the proper place to teach technic is when the boy feels the need of it.

Fourth Step

In the fourth and last step in the project method of teaching the pupil passes judgment, he checks up on results and surveys the problem in its complicated form. He asks himself, "Will it work; what changes could be made in both planning and execution?" He criticizes his own work.

Thus we see that when the project method is used as a unit of instruction it serves as a thought-provoking problem for the pupil. We also observe that even though the pupil initiates, plans, executes, and criticizes his own work, the teacher has very important duties to perform.

We also observe that when this method is used the teacher aims at things more fundamental in the boys' development than skill, tool manipulation, and the proper making of certain joints. It comes nearer to basing the work on Dewey's philosophy in which he states that "education is life."

If properly used this method should increase the power to purpose clearly. It should develop deliberate purposes rather than haphazard purposes, and the purposes should cover a wide range of material.

In planning, the boy should have developed the ability to plan more carefully, to organize better his material, and to plan things more complex.

In regard to execution he should develop greater skill, develop perseverance and those qualities which will cause him to carry his project to completion.

In regard to judging, he should have developed higher ideals of workmanship and better notions of planning.

There should be an increase of self-reliance, concentration, cooperation and ability to accept responsibility.

As educators are advocating the thought-provoking problem as a unit of instruction, I desire to say in conclusion that it behooves industrial arts teachers first, to carefully consider the project method, as a means of teaching boys rather than teaching only processes and the proper making of joints, and second, to consider carefully the question of teaching something else besides woodwork.

Much of the criticism of industrial arts work is due, no doubt, first to the fact that the work is so formal in its organization and method, and second, that woodwork is the only activity offered in so many schools. If this criticism is just, what is to be done about it? The progressive teacher will seek new methods. The use of the project method, together with a greater number of activities represented, may help to solve the problem; at least, it deserves a fair trial.

Graphic Aids in Orienting the Job Sheet in the Shop Lesson

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THE job sheet is receiving much attention now in connection with the handling of shop and drawing classes in junior and senior high schools, vocational schools, and special classes. In many instances the shop teacher has unconsciously worked under the assumption that when the job sheet is made, the lesson is planned. This assumption, of course, is not correct. The job is planned but the lesson is not. In the planning of any lesson, the five major steps in the Harvey lesson plan must of necessity be worked through by the teacher to insure a first-class piece of teaching.[1] Fig. 1 has been used in teacher conferences and teacher-training conferences in connection with the discussions of three questions:

1. What is the relation between the job sheet and the lesson plan?

2. What does the shop teacher do in planning a lesson when the job to be taught is already worked out in the form of a job sheet?

3. What forms of arrangement will be used in the different parts of the job sheet?

This article is by way of explanation of Fig. 1 in connection with its use relative to the above three questions.

In the first consideration of the lesson plan and the job sheet for the industrial teacher, agreement is necessary as to what constitutes the content of the lesson plan and what constitutes the content of the job sheet. The Harvey lesson plan carries five major propositions. The first proposition indicates the accomplishment which is set up for the lesson. The second is the analysis of the job or piece of work to be performed in the lesson, i. e., what must be known and done to accomplish the purpose. The third is the analysis of the pupil in terms of the requirements of the job to be performed, i. e., what the pupil already knows and can do of that which is included in proposition two. The fourth is the result of the analysis of the pupil in terms of the job, and is a specific indication of the new things to do and the new things to know in the job to be taught. The content of proposition four, i. e., what remains to be taught and done in the order in which it is to be taught, is a selection from the total under proposition two to teach to the pupils under immediate consideration. Proposition

[1]For detailed discussion of the Harvey Lesson Plan, see "The Lesson Plan, Job Sheets, and Graphic Aids," by C. A. Bowman and F. E. Tustison, Industrial Arts Brochure No. 2, Bruce Publishing Company.

four cannot be properly worked out until the first four propositions have been completed. The method of teaching calls for consideration of the *purpose* which is similar to the purpose in proposition one. It calls for *preparation* which is activity on the part of the teacher in testing, questioning, and use of other pedagogical devices designed to bring into the immediate circulation of the lesson, the contents of proposition three, namely what the pupil already knows and can do. The *presentation* is that part in the method of teaching in which the teacher through demonstration, lecture, or other devices puts across to the pupil the contents of proposition four. In the *application*, consideration is given in the lesson to the use of the new material put across to the pupil, and in the *drill*, there follows enough use of the new material to clinch it in the possession of the pupil.

The foregoing is the work of the teacher in planning his lesson. As is indicated on the chart, the job sheet content originates from propositions one and two of the lesson plan. The job specification and the orientation paragraph originate in the purpose of the lesson plan. The statement of materials, tools and equipment, procedure, questions, references, and records originate in the what must be known and done to accomplish the purpose. When the job sheet has been worked out, the teacher may consider then that he has propositions one and two of the lesson plan prepared. The questions, references, and records in the job sheet may also have some relationship so far as origin is concerned in the steps as indicated under the method of teaching. This portion of Fig. 1 is of assistance in handling the first of the three questions mentioned above in this article, i. e., "What is the relationship of the job sheet and the lesson plan?"

In considering the second question, i. e., "What does the teacher do in planning a lesson when the job to be performed is already in a job sheet?"—the first step is proposition three of the lesson plan. In scanning the procedure, the teacher would check those items listed which the pupil in his judgment already knows and can do. This is indicated in Fig. 1 under proposition three and "may be checked under two." He will then scrutinize those things which must be done and which must be known as indicated in the procedure of the job sheet which, after the checking under proposition three, are indicated as being new to the pupils who are doing the job. He will then think through the manner in which he will bring into the lesson those things in the procedure which were checked as being already known or already in the skill of the pupil. He will then make his plan for the demonstrations, arrangements of materials and tools, and think through the manner in which he will conduct the lesson to "put across" to the pupils the new things to be done and the new things to be known.

In considering the various forms of arrangement for the job sheet, several alternatives are available in arrangements of the content of the job sheet, and several alternatives are available in the arrangement of one job sheet after another. In considering the forms of content, recognition should be made also of the two kinds of illustrative material which add greatly to the efficiency of the new job sheet.

One type of illustrative material serves to illustrate the orientation paragraph. As indicated, this material

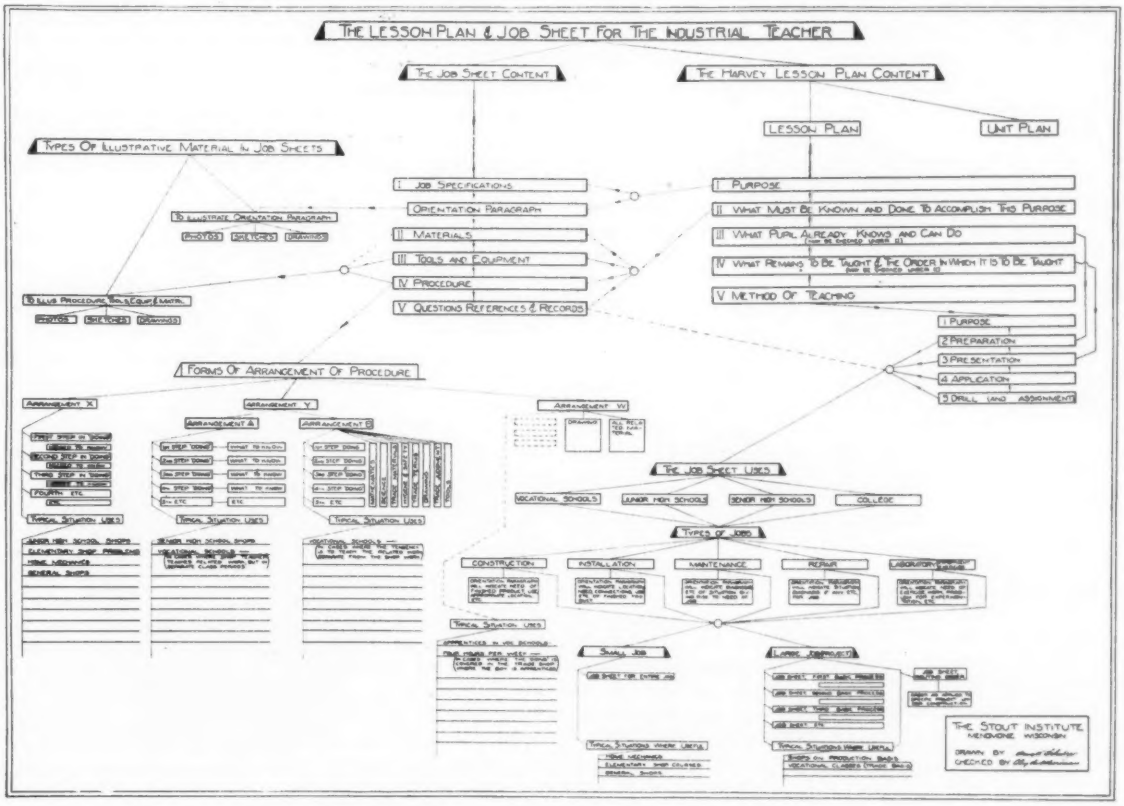


FIG. 1. CHART FOR THE LESSON PLAN AND JOB SHEET FOR THE INDUSTRIAL TEACHER.

may be either photographs, sketches, or drawings. The purpose of the orientation paragraph is to give to the pupil the significance of the job he is about to perform. Details on this follow later. The other type of illustrative material which may also be either photographs, sketches, or drawings, is that which is included in the job sheet to illustrate materials, tools and equipment, and procedure.

In the consideration of several forms of possible arrangements of the procedure in the job sheet, it should be kept in mind that numerous modifications are possible of the arrangements suggested as are also numerous combinations. Arrangement X is convenient, especially from the teacher's standpoint, in view of the fact that the information which the pupil needs to know for each step in doing in the procedure is listed immediately following that step. Typical situations where this arrangement is convenient are junior high school shops, shops where elementary problems are being handled, in home mechanics, or in the similar problems in the various forms of general shops such as the general metal shop, etc.

Under the arrangement Y there are two probable forms with numerous modifications and combinations of the two possible. Arrangement A under Y calls for the same content in the procedure as that listed under arrangement X except that, instead of a single column, two columns are used. In this arrangement that which is necessary for the pupil to know in performing the first step in doing is listed opposite instead of under. Occasionally two sheets are used, one for each column. It is desirable, however, wherever possible to keep the material on the same sheet. This form is of use in the senior high school or vocational school work where emphasis is placed upon the related work. This emphasis may be placed either in separate recitation periods, or as an integral part of the instruction in the shop, but in either case this arrangement is convenient where it is taught by the shop teacher.

Arrangement B calls for a classification of the material which must be known, classifying it according to kinds, such as mathematics, science, etc. This arrangement is convenient in all situations where the tendency is still to handle the related work in some form of separate class. A combination of arrangements B and A may be made by listing the what must be known for the step opposite that step, but classifying the information according to the headings mathematics, science, etc.

Arrangement W is the one which occasionally is necessary in planning job sheet content where the things done are performed by the apprentice in the shop where he is apprenticed. The material actually taught in the school is that which is the drawing and other related information. The doing must be recognized in this instruction as the basis or core for drawing and related information being taught. The actual doing of the work, however, is in the apprentice or trade shop rather than in the school.

In consideration of job sheet uses, recognition is made first of the fact that they are of use in virtually the entire range of schools—vocational, junior high school, senior high school, and college. Expansion of the chart here is possible indicating departments of work and subjects within departments in the various schools.

In the types of jobs for which job sheets in one arrangement or another are convenient, two classifications must be recognized. Jobs may be classified, first, according to the nature of the work as indicated in the group recognizing construction, installation, maintenance, repair, and laboratory. In connection with each of these types of jobs in this classification, slight modifications are necessary in selecting the content for the orientation paragraph which is placed in the job sheet immediately after the job specification. In the orientation paragraph of a job sheet written for a construction job, it is necessary to include as a part of the content a statement of the need and use of the finished product. Appropriate location is sometimes a desirable piece of information. If the job is one of installation, the orientation paragraph may properly include information on the need and use of the finished installation and usually carries a brief description of the location or situation in which the installation is made. If the job is one of maintenance, the paragraph will usually carry a statement of diagnosis. This includes the locating and interpreting of symptoms as they might be called, and is the analysis and interpretation of the situation which gives rise to the necessity of the maintenance job. If the job is one of repair, the orientation paragraph frequently has in it the elements in the paragraph for a maintenance job and for an installation job. The repair job is usually one that is necessary when the machine or part on which the job is to be performed is out of use. The maintenance job is usually in a situation where the article is not out of use. For instance, maintenance work can be carried on in bridge work and the bridge remain in use but bridges are usually "closed for repairs." It is also sometimes necessary where the workers in the school shop are learners or beginners to make some slight use of what might be called an exercise or laboratory experiment. Where such is necessary and it is not used unless it is a necessity, the orientation paragraph will indicate the need of the exercise or experiment and will show its application in actual work.

An additional classification of types of jobs on the basis of the small job and the large job is also necessary. A small job is the one frequently found in groupings of occupational work in such courses as home mechanics. In such instances the job itself is small enough in scope so that a job sheet may be written for the entire job. The other classification, that of the large job or project, is the situation which will be found in all school shops on a productive basis in senior high schools, occasionally in upper grade junior high school work, vocational schools, etc. In this situation the teacher is confronted with the problem of getting out production results, and at the same time maintaining instruction. Every project can be divided into basic trade processes. The teacher in such a shop in planning the project, would make out the routing order indicating the basic processes, in the order in which they would occur in the project under consideration. This routing order would indicate the order of work on the project and would carry such information of a technical nature and of the nature of particular application to the project under construction as would be necessary. It would refer the pupil to the job sheets on the basic processes as they are necessary in carrying on the instruction. This use of the job sheet lends itself in a very helpful manner to the shop situation where the work must be divided, and small groups of boys assigned to certain parts of the construction of the total project. Material assistance is given to the work of the teacher in rotating boys from one part of the construction to another. The routing order in this instance may be in precisely the form of job sheet indicated under the heading "job sheet con-

tent." Under the procedure references will be made to the job sheet on the first basic process, to the job sheet on the second basic process, etc. These job sheets on basic processes would be constantly referred to and used over and over in one project after another as the work of the shop completes one production job and takes up another.

In the classes in the Stout Institute, use is made of the job sheet for the small job with students in home mechanics and in some of the beginning classes in single activity shops. Use is made of the arrangement suggested for the large job or projects in printing, machine shop, auto mechanics, mill work, cabinet-making, bricklaying and concrete, etc. The material in the latter part of this article has referred to the third question previously mentioned both in relation to "What forms of arrangement will be used in the different parts of the job sheet?" and where these forms are most helpful. Fig. 1 is condensed. The writer believes, however, that it is in sufficient detail to suggest the breadth of possibilities of job sheet use. It has been found in the classes at the Stout Institute *where the job to be taught is already worked out in job sheet form, that a much more efficient performance on the part of the teacher may be expected in planning and conducting propositions three, four and five of the lesson plan.* In the teacher-training classes, practice teachers are required to plan all lessons. The job sheet has increased the efficiency of such planning. If the teacher in the shop regards the job sheet as an analysis of propositions one and two of the lesson, these propositions, especially proposition two, relating to the job with the understanding that propositions three, four, and five must be accurately worked out before conducting the class in which the job sheet is to be used, it will be found that the job sheet as an instructional aid will be of material assistance. It is simply like other efficient tools and devices—when not understood it can be misused.

Britannia Metal
XIV High Raising

Professor William H. Varnum, University of Wisconsin

FROM the preceding articles, one realizes the possibilities inherent in the metal, Britannia. School projects may be based on modifications of antique ware suggested by such articles as ladles and spoons, jugs and flagons, cups, beakers, tankards, altar and home candlesticks, dishes, salt cellars, egg cups, measures, cream pitchers and sugar bowls, water jugs, coffee and chocolate pots, bowls, vases, mustard pots, salvers, plates, tobacco boxes, soup tureens, vegetable and salad containers, trays, tea caddies, ink stands, shoe buckles, trophies and loving cups, finger bowls and trays.

Modern industrial practice suggests lighting fixtures, lamps, push buttons, push plates, door knockers, cabinet fixtures, inlays, desk fittings and scout equipment.

ILLUSTRATION 1. GOOD PEWTER DESIGN.

For beginners it is preferable to undertake simple beating down projects as small plates and trays requiring but a short time to complete and not unduly technical in construction. Forms with hollow handles and spouts take much more skill and a longer interval to complete and should be reserved for pupils who can concentrate upon work for some time without tiring. The satisfaction derived from completing ware of this type often

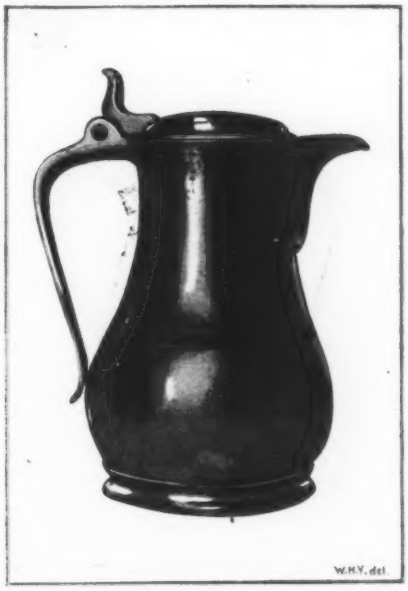


ILLUSTRATION 2. TANKARD OF EXCELLENT PROPORTIONS.

compensates for the amount of time it consumes, while a duplicate may be completed in about one-half of the time taken for the first attempt. For educational and technical progession, duplication is unwise and may be left for outside problems; by this method sets are completed without destroying the sequence of the course.

The ancient pewterers recognized different grades of technical progression. For example, the early French

PLATE 1. SMALL BRITANNIA OBJECTS.

workmen were differentiated into slightly varying guild organizations as follows:

1. *Les potiers dits de ronde* who were required to raise a vase in one piece before being admitted to the *maitrise*. The process is a difficult bit of hammer work and hardly adapted to modern Britannia.

2. *Les potiers maitres de forge* (master pewterers). This guild placed its qualifications upon the ability of workmen to make a bowl and a dish with the hammer.

3. *Les potiers menuisiers* (joiners) who were concerned in the making of small articles like toys, badges, and rings. According to Masse, they were required to make some small articles, like an inkstand, to illustrate their proficiency. These test articles were in the nature of a modern essay, as marking the ability of the craftsman.

To avoid an unfinished amateurish aspect, great care should be taken in finishing the ware, removing scratches

with fine emery cloth and oil, or tripoli, and the polishing wheel. Triangular scrapers, bronze workers' files, chisels, engraving tools, and rounded sticks or dowels for polishing, aid in removing unsightly lumps of solder and bring the ware to a proper state of smoothness. Small pieces of solder will help in producing professional joints.

While the spoons and ladles on Plate 1 are of comparatively modern pattern, the ancient pewterers considered such articles as in the hands of the "triflers," or workers in trifle metal, who were concerned with making lighter ware. Indifferent workmen were retained as spoon makers, the cleverer men being advanced to the sadware branch of the trade. On occasion, spoon making towards modern design is illustrated by the *Pied de Biche* (deer's foot) spoon of the same plate.

In constructing both spoons and ladles, it is well to cast or solder together a thick form roughly suggesting the desired shape in the flat, afterwards expanding the bowl and handle end of the spoon as in Figure 1 of Plate 1. By turning the blank edgewise on a mushroom anvil, the stem may be made thicker and stronger (Figure 2). After this process, the spoon or ladle is sawed and filed to the correct contour and polished. The spoon is then finished by shaping the bowl within a hollowed block of hard maple.

Figure 3, Plate 1, is a detailed constructional view

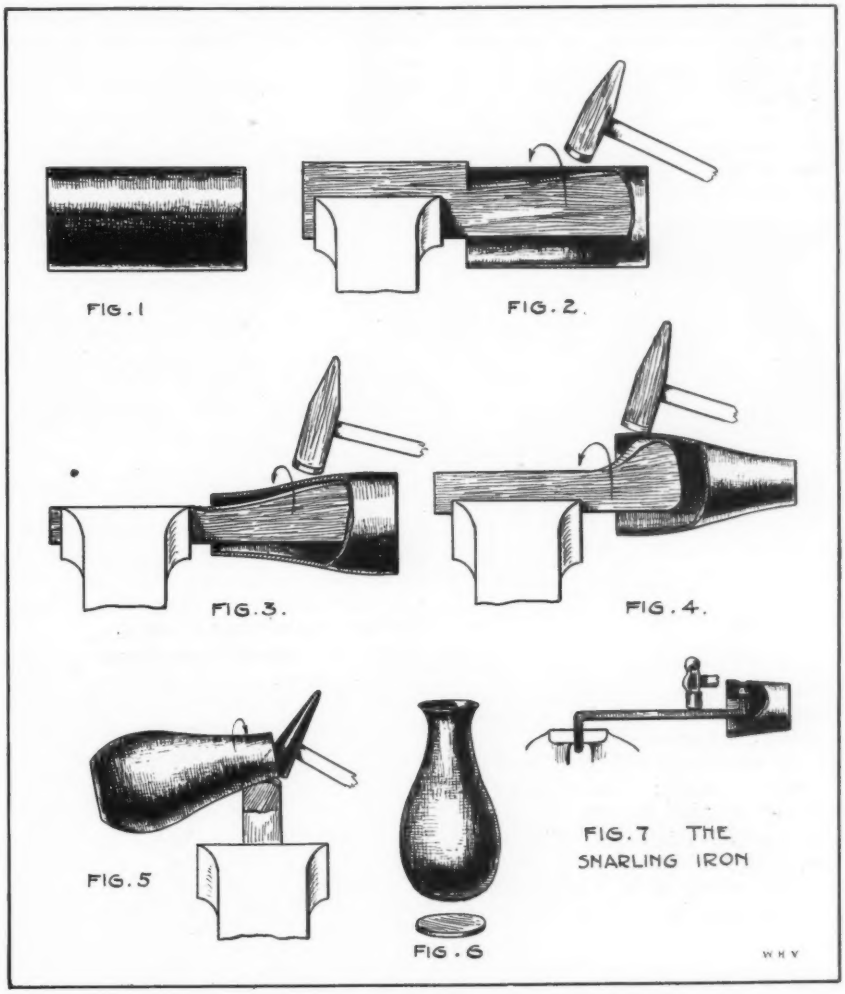


PLATE 2. HIGH RAISING FOR BRITANNIA.

was reserved for men with defective vision. The earlier spoons were finished by hammering. Often weak in construction, they failed to resist the necessary pressure of daily use and consequently few old spoons are to be found in the hands of pewter collectors. The thinness of the stem and strain upon the point where it joins the bowl rendered it liable to serious damage. Hence, in designing both ladles and spoons it becomes necessary to thicken this part of the article as will be seen by referring to modern silver tablespoons.

Bowls of early spoons were narrow where modern spoons are broad, as shown in the Seventeenth Century English spoon of Plate 1. A transitional type trending

of the parts included in the individual salt. Unfortunately the massive master salt, which formerly occupied such a prominent place in the table service, no longer is in current use. The four parts necessary to produce the individual salt are formed by the raising and beating down processes previously described. By turning the base member it becomes possible to construct the salt container in two major parts. Strengthening the rims both of the salt and the egg cup by means of half-round wire adds strength and service to the objects and delicacy to their design.

Many olden cups and vases will suggest trophies for athletic or forensic contests. Whenever sterling silver

is undesirable or too expensive, Britannia offers a valuable substitute; moreover the making of a cup will become an excellent class project in which many can participate. A suggestion for a trophy of simple design is given in Plate 1, with Figure 4 indicating its major construction as follows: A cone shaped body is soldered with a butt joint, expanded at one end over a round end stake and contracted over a T stake to form the base. A round plate is attached to the base and the problem is completed by cast handles.

From the list of objects mentioned in the opening paragraphs of this article, one finds a number of examples calling for the production of high raised cylindrical forms. In designing such forms, American ideals of the Colonial period or early English standards making for simplicity and permanence, robustness of curvature combined with delicacy of detail, and good proportioning should be regarded as the goal for good design in Britannia.

ILLUSTRATION 3.

Illustration 1 depicts an excellent model with its robustness of body lines and delicacy of neck and base, combined with a sense of permanence and good proportion. Illustrations 2 and 3 are equally good. While the bases in the illustrations are turned, it is possible to get excellent results from the raising process, with the natural simplification for technical reasons.

Variety in problem selection is urged. The stereotyped pen trays and card receivers of many art-craft courses fail to do justice, either to the imagination of the instructor or to the richness in possibilities of which the material is capable.

Methods for High Raising

Methods for raising a high cylindrical form, similar let us say to Illustration 1, require slightly different methods of attack from those heretofore considered. Plate 2 illustrates a detailing of the process. A cylinder of Britannia slightly less in height than the desired design and in diameter equal to the greatest diameter of the project is securely soldered by butt joint construction. For large ware at least seven or eight inches high, a piece of hard maple one and one-half inches thick is shaped as in Figure 2, Plate 2. Place the cylinder of Figure 1 on the stake and, using a wooden mallet, proceed to give a series of light overlapping strokes around the cylinder, beginning at a point where the design starts to curve toward the neck, thus forcing the metal in about one-eighth of an inch until contact with the stake is secured. As was the case with low raised forms, the cylinder is rotated under the mallet by the left hand. One can feed the cylinder under the mallet to the extent of three strokes, then a pause should be made while the left hand takes a fresh grasp of the cylinder and three more blows are struck and so on. The mallet remains in exactly the same place and the cylinder is fed under it until a complete circuit of the form is completed. The hammer hand is then advanced about one-half inch and a new circuit is started practically overlapping the first series. The process is termed "coursing" and is continued until the neck end is reached. It is customary to rotate the cylinder clock-wise. The sound of one-two-three-pause, one-two-three-pause, emanating from the hammer is quite typical of the coursing process and strangely enough this rhythmic tapping minimizes the fatigue of the coursing beginner.

Coursing contracts the metal and hence beginners frequently cause wrinkles of metal to be formed. The more skilled one becomes, the less the metal will wrinkle; but wrinkles must be hammered out at once or cracks will appear from their folds. Figure 3 shows the second stake used to complete the contraction of the metal body. A cross-section of this stake will approximate a similar section of the vase form taken at a corresponding position. Coursing, as described, will bring the vase to the desired shape. Rather than force the metal unduly, it is better to reduce or contract the body by repeated coursings from middle to end as a much better shape is maintained by slowly bringing about the reduction. If splits appear or the joint opens, bring the edges together and resolder.

The third hard maple stake, shown in Figure 4, is used to draw in the bottom of the vase, while a slightly hollowed piece of hard maple is utilized to flare out the neck with strokes from a horn mallet. Figure 6 is of the completed form ready for the base plate which is cut a trifle larger than is necessary, soldered and filed to conform with existing contours.

One will find on the market metal stakes accomplishing practically the same thing as the hard maple forms, but for many reasons the hand-made wooden stakes are to be preferred for Britannia. The metal thus is kept in a softer and more workable condition while as the hard maple is smooth and even on its contact surfaces, the stake is less liable to mar the Britannia.

Occasionally dents will cause annoying defects in the ware. The snarling iron of Figure 7, Plate 2 will quickly eradicate them. This stake is a long springy bar of metal with a rounding polished anvil head. Attach the snarling iron to the vise, press the head directly below the dent and with a ball and pein hammer strike the snarling iron a sharp blow; the rebound will readily press out the blemish.

(To be concluded)

"Modern civilization rests on machinery. No education, no culture, for any social group, can be sound and sufficient that does not recognize that fact." Says Frank P. Whitney, assistant superintendent of the Cleveland, O., schools. "This is the industrial age. Industry is the omnipresent and unescapable fact of modern life. Mechanism on a stupendous scale confronts us. We have been outfaced by this monster which we have created. Whole ranges of life have been mechanized and routinized where formerly fancy and imagination had free play."

Lesson Plans for Shop Men

Francis E. Mack, Instructor, Woodworking, Junior School No. 3, Trenton, N. J.

TOO often in the past, the procedure in shop practice has consisted in having a list of projects at hand, with drawings, graded as to difficulty of tool operations, and in seeing to it that the pupils went through the course as listed. Happily that practice is almost non-existent today. Teachers are giving more attention to the educational values involved, not limiting their aim to the acquisition of skill in the manipulation of tools. There is a danger, however, of under-estimating the worth of good craftsmanship, in our enthusiasm for these other worth-while values.

One source of our difficulty is the failure of planning our work, trusting to a great extent to our memory.

TRENTON PUBLIC SCHOOLS
DAILY LESSON PLAN SHEET

WEEK OF _____ TEACHER _____ SUBJECT _____ GRADE _____ SCHOOL _____

CLASS PERIOD	SUBJECT MATTER	PURPOSE	TIME	PROCEDURE	ACCOMPLISHMENT

DAILY LESSON PLAN SHEET.

Perhaps, in our past experience, some of us have met our classes, which came at various times and at varying periods, and wondered just how far we had gone with any particular class during its last shop period several days ago. Another source of our difficulty lies in the fact that, in too many cases, the instructor fails to analyze his job, consequently not seeing what might be taught through the construction of any given project. To analyze a piece of work, and use it as a means of endeavor, is the educational task of the shop instructor. The instructor may have a course of study in his desk, but after one cursory reading, it usually stays in the desk drawer, and if he were asked for it, he might have difficulty in locating it. And that brings me to my topic—*lesson plans,* which are a check on whether or not we are putting across our job, as outlined in the course of study.

Many teachers may look askance at the very mention of the term, *lesson plans,* claiming that those who use them are aping the academic teacher, and that they are losing sight of the technical aspects. This is not true, however, for by just the mere making out of the lesson plans, we are analyzing the jobs for its skills, etc. In fact, lesson plans of some description are absolutely necessary; for they not only aid us in getting the most values from our projects, but they are a check as to our accomplishment of our aims. No one will say that any large industry, or commercial enterprise, which has certain definite goals or results to be derived from its efforts, trusts all the necessary information, methods, etc., to the memory of the superintendent, office force, or foremen. A contractor constructing any dwelling, school, or office building, has his plans and specifications. These he is constantly referring to, checking up his job as to materials, operations, and time. These enterprises may not have lesson plans, but they have the equivalent. We, who are supposed to be carrying on in the manual arts field, must adopt some such procedure, which will lessen the strain on our memory, and give us the opportunity for effective instruction. Just as in industry we must have a careful analysis of the job; we, as shop men must plan so that we can obtain the results, which are desirable—those of skill, good habits, and industrial information.

Analysis—Organization

The success of our work is directly in proportion to our analysis of our job, and our organization of the ideas (found by the analysis) into an orderly procedure. Here is where the lesson plans function. If we would take our course of study, analyze it to find the aims, methods, and then organize the projects and materials, to meet these aims, we shall travel much further in any given time. For example: A class in the seventh grade is working on craft projects, one group constructing boats; another group constructing fern-stands, a third group constructing airplanes, and a fourth group constructing stools. The projects under construction are determined by the skill displayed in previous work, and by choice of the pupils.

Had we a project plan sheet, for the purpose of determining the aims, methods, procedure, and accomplishments, we might teach with more economy both as to time and materials. In analyzing the above listed craft jobs, we discover that, as desirable outcomes, we find skills, habits, and information, both technical and general. In still further analyzing the skills, we find that we are coming down to very definite things, proper use of tools, and correct procedure in squaring the parts that

TRENTON JUNIOR HIGH SCHOOLS
MONTHLY (PROJECT) PLAN FOR BLOCKING OUT SUBJECT MATTER

MONTH OF _____ GRADE _____ TEACHER _____ SCHOOL _____

	PROJECT	OUTCOMES: SKILLS	OUTCOMES: HABITS	OUTCOMES: INFORMATION	CORRELATIONS	ACCOMPLISHMENT
SEVENTH GRADE						
EIGHTH GRADE						

MONTHLY PROJECT PLAN SHEET.

make up the job, the reading of the drawing, selection of the right kind of lumber suitable to the purpose, etc. Under habits we wish to emphasize, let us say, accuracy, and under the information outcome, we find that upon completion of the project, the pupil should have a knowledge of the source of materials; e. g., lumber, kind used, particular characteristics, location of forests, need for conservation. Also, when the project is completed his vocabulary should have been enlarged by a knowledge of the names of tools, names of operations, and names of materials. A space on our monthly or project plan should show possible correlations with other subjects, and in the space alloted should be placed the definite correlations which the project permits. In the case of the craft

project, there certainly is opportunity for correlation with mathematics, drawing, and English.

What has been said so far about lesson plans refers to a *project plan* which is for the purpose of blocking out the subject matter, and to give a better analysis of the job. In conjunction with this project plan, there should be a weekly plan sheet, showing what classes come to the shop, and at what periods. On this sheet we should note the particular unit of work or instruction for each given period and for each class, show its purpose, and note the procedure which it is intended to follow. Last of all should be a space for noting what has been accomplished in each period. Now, if you have printed forms similar to those shown here, which you can fill in with this material, it will not take long to plan your work, and the results accomplished will offset any trouble or work entailed. Many of us have taught for several years without a plan sheet, simply keeping notes of what we had accomplished, and to a degree trusting to memory as to what we should want to do at given periods. For the past several years, however, some of us have used a type of lesson plan sheets both for projects, and as weekly outlines. In my own case I find that I do much better; for I have anticipated my week's work, have analyzed my projects, know the desirable outcomes before hand, and work definitely with those ends in view.

However, we must not become a slave to our lesson plans. We *must* have them to be efficient, but occasionally there are times, when, as some educational authority once said, they are good things to depart from. Situations arise which demand immediate attention, requiring for the time being, departure from our plan. By all means depart from the plan. Keep in mind that the value of the project or "blocking out" plan, lies in its requiring of us to analyze our projects for all possible values, organization of these values in a logical form, and the sense of satisfaction resulting from knowing that we are getting the most out of the project for the boys. The daily or weekly lesson plan is simply a means to help check up on our project plan, and relieves us of the strain on our memory.

A Self-Cooling Fountain

Louis J. Haas, Director of Therapeutic Occupations,
Bloomingdale Hospital, White Plains, N. Y.

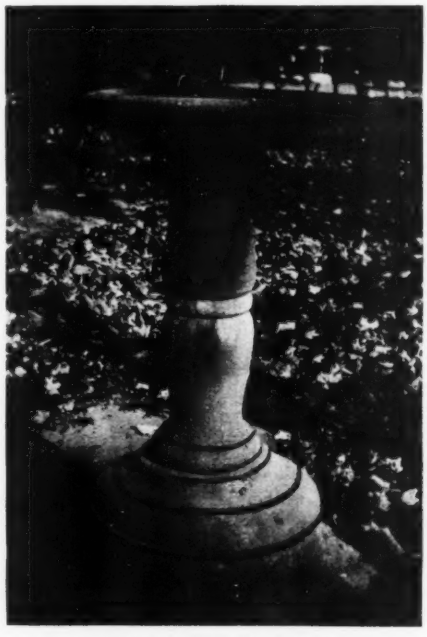
There are a number of points where the experiences of the instructor of industrial arts and the occupational therapist fall in parallel lines. One of these is the fact that much that is good and helpful may be accomplished through the project which meets a local need. Such projects when presented with the students' best interest ever in view, whether he be the young man just preparing for life's work or the sick man preparing to again take up life's tasks, accomplish the maximum.

It is not the purpose of this paper to enter upon an exposition of the application of certain teaching methods and the information to be thus imparted to the normal student, nor to consider the value of certain types of projects when used as therapeutic treatment for those who are sick. It is desired only to present a project found useful in the latter sphere of endeavor, which it is believed may be of service to those engaged in the other.

The self-cooling drinking fountain brings into play in its construction a number of elements of recognized educational value—design, public hygiene, drafting, sheet metal work, carpentry, cement turning, excavating, and plumbing. One need not dwell upon the possibilities for imparting much related information through the development of such a project. As a result of these correlated activities there is finally produced an object of interest and public service.

In the INDUSTRIAL-ARTS MAGAZINE for October, November and December, 1922, and January, February, and March, 1923, was explained the method of cement casting and turning as developed in the Men's Occupational Therapy Department of Bloomingdale Hospital. This article gave at length the details of this method as applied to the construction of various projects. The reader is referred to this article for full information, only such details being given here as relate particularly to this project.

A study of the elevation of the fountain in the drawing, plate 1, will show it consists of a concrete base, a standard, and a basin. The standard for convenience in turning is made in two sections, the concrete being turned as soon as it gets its first set (within two and a half to three hours of the time it is tamped). Thus the fountain consists of four sections of turned concrete: the base, two standard sections, and the basin. These represent in a way the outward form of the self-cooling fountain, and while these are essential, it is the parts hidden in the ground that make the fountain self-cooling. While the details of each part of the fountain must be carefully studied, if the most satisfactory results are to be obtained, it seems best to consider first the cooling system. Upon



SELF-COOLING FOUNTAIN.

the proper design and construction of the cooling system really depends the successful operation of the fountain. The other features of the fountain unit will be considered later.

The fact that the earth at various depths has temperatures lower than those at the surface in summer has been observed by most races who can use this fact. Thus

for many centuries those who had occasion to preserve solid and liquid food, which requires low temperatures, exercised this principle or natural law in various ways. The following examples are found: placing such objects in springs where the water comes from the earth cooled, hanging in wells either in the water or just above the water's surface, placing in natural or artificial caves, dugouts prepared for this purpose, and of more recent years placing in spring houses prepared with troughs, through which the spring water passes and cools the food placed therein. And finally, many who have made no special provision for preserving food by cooling, have found that the ordinary house cellar which sets deep in the ground maintains a low temperature during warm weather.

With this wealth of experience, both historical and contemporary, it is strange that this principle does not seem to have been applied to drinking water obtained from modern water systems. It is believed that some efforts have been made in recent years, but with little success due to the faulty design of the cooling element.

In designing our own initial fountain, it was believed that success depended upon two things: first, capacity of the cooling element, and second, the depth at which it was placed in the ground. Therefore, in designing the cooling element the capacity must be studied in relation to the volume of usage and the distribution, whether even or broken into peaks and low points; if the latter, the volume and duration of the peaks and the intervening "lows" must be considered. All these factors control the size of the cooling element. It is also essential, under certain conditions of usage where the demand is heavy and continuous over a period of a number of hours, to plan not only a cooling element of large cubic capacity but one that presents the largest possible surface to the cooling action of the earth. The cooling element may take two forms, the tank and the coil. Each has definite advantages which make it meet certain needs more satisfactorily than the other. Success will depend upon how carefully the local needs are analyzed and the designs of the cooling elements adapted to meet these conditions.

Some insight into the local needs which our initial fountain was designed to meet, may be helpful. Placed upon the hospital lawn, it is easily accessible to three separate groups of patients who exercise or sun themselves during the hours of 9:30 to 11:30 a. m., and 1:15 to 4:30 p. m. These three groups total about sixty patients and on certain days during the afternoon, when augmented by visitors, the total number of probable patrons may reach 75 individuals. Within the area served by this fountain are found two tennis courts which are in use by eight patients from 9:30 until 12 o'clock noon and in the afternoons often from 1:30 until 5 p. m. It will be noted, therefore, that the demand upon this cooling element is constant during these hours, evenly distributed over the two periods. While the fountain is used at other times of the day, this usage is so light that no thought need be given to it. The volume of water used during each period is small, while the interval of rest between the two main active periods is long enough to allow the cooling element to recover from the preceding activity. Considering all these factors it was decided that a fifteen-gallon galvanized iron tank would make a cooling element of sufficient capacity and present enough surface to the earth to function satisfactorily. If similar conditions are to be met, with the one exception that a larger number of individuals are to be served, the same form of cooling element simply increased in capacity would function satisfactorily.

Where conditions are such that peak loads are to be met with, another form of cooling element may be needed. If the usage is light and continuous throughout a period, with one peak load of short duration within the period of activity, the tank form of cooling element of sufficient capacity would seem the best to use. When the usage comes in a number of peak loads of ten or fifteen minutes, with rest periods of only thirty to 45 minutes, the coil type of cooling element of sufficient capacity to take care of the heaviest load is the type that will be found to function most saisfactorily. The coil type of cooling element presents the largest possible cooling surface for any given cubic capacity. Study of local conditions as outlined above, designing the cooling element to meet these, will guarantee perfect functioning of the completed fountain.

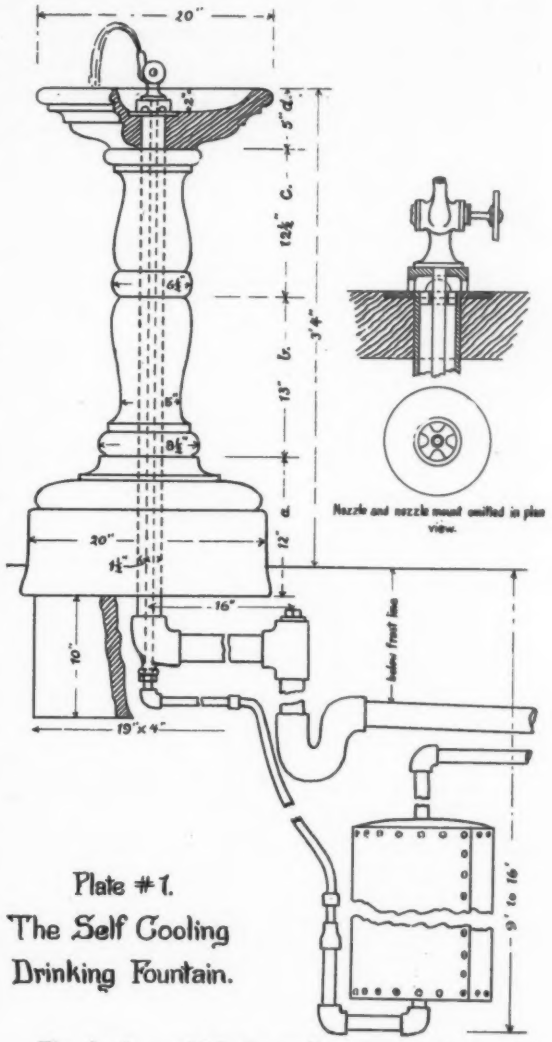


Plate #1.
The Self Cooling Drinking Fountain.

The depth at which the cooling element is placed is an important factor in supplying water cooled to a pleasingly low temperature. The depth varies with conditions and should be carefully studied. In sinking the shaft to receive the cooling element, it was observed the temperature dropped as the shaft sunk deeper; this was first noticed at four or five feet below the surface when tested with a thermometer. At a depth of eight feet the reading was 55° when the temperature at the surface stood at 80° to 85° degrees in the shade. Surface water which started to trickle into the shaft when a depth of six feet was reached and finally rose to a depth of 1½ feet and showed a temperature of 50°. It is not believed this is the lowest temperature at this depth as the direct connection with the surface raises the temperature some-

what. After this test it was decided to place the cooling element at a depth of eight or ten feet below the surface. When completed, the bottom of the tank or cooling element of this fountain was nine feet below the surface. After the fill had been tamped in place and the fountain connected, the water was not tested for ten days to allow for dissipation of the acquired surface heat. After allowing fifteen seconds for the head of water above the cooling element to run off, the water tested 45° while the water supplied to the cooling element tested 65°. Drinking water cooled to 45° is quite pleasant to taste when it is 85° in the shade. It is believed the temperature could be lowered further if the cooling element were placed deeper. Installation of fountains at points further south, where the surface temperatures are higher, would indicate the need of placing cooling elements at depths varying from 12 to 16 feet.

The water is supplied to the cooling element through a ¾″ galvanized iron pipe connected to the top of the tank. The outlet is through a ¼″ or ⅜″ block tin tube, connected to the bottom of the cooling tank. This tube is connected with the brass outlet pipe running through the fountain pedestal. The outlet tube is small so as to reduce to the minimum, the head of water that must run off to bring the cool water to the drinking nozzle. The drawing (Plate 1) will explain the details of the piping connections, etc. The nozzle should be of the self-closing type. It will be noted that the outlet tube which connects the cooling element with the nozzle, runs through the ½″ pipe placed in the standard of the fountain to receive the drainage. This tends to cool the head of water in the outlet pipe. The larger detailed drawing shows clearly how the nozzle is connected and mounted in the center of the basin. This drawing also makes clear the provisions made for draining the basin.

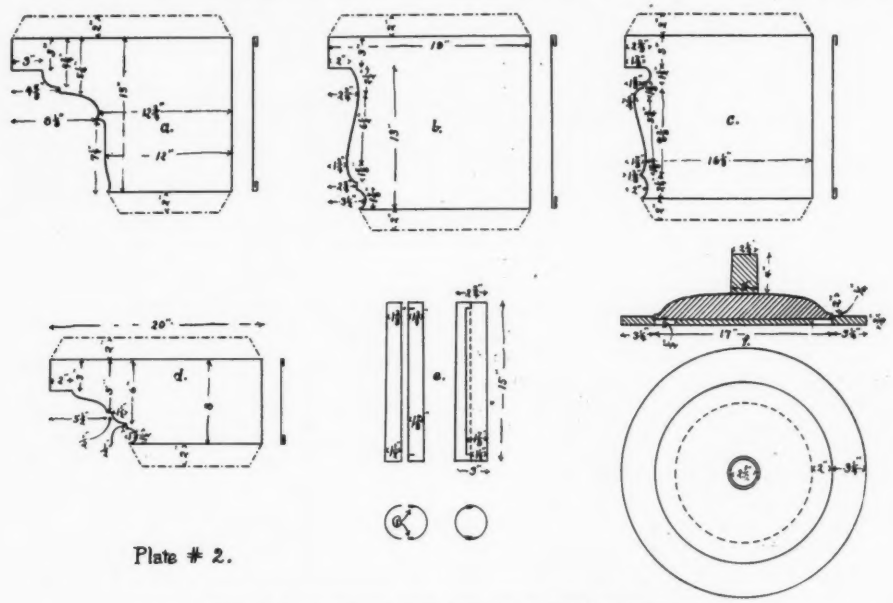
Drawings A, B, C, D, Plate 2, show the templates used in turning the four parts of the concrete structure of the fountain. These templates are designed to be used in connection with the type of hand driven turning mill shown in Plate 3. This turning mill is more simply constructed than the permanent type of power-driven mill, the design of which accompanied the series of articles on "Cement Casting and Turning" previously mentioned. The templates are designed to be held in the slot of the template arm marked A in Plate 3. When the template is adjusted, the set screws are tightened to keep it from slipping and the cutting is accomplished by turning the table carrying the concrete blank (concrete stock) towards the template. As soon as the first cut is complete, loosen the set screws, drive the template up 1/16″ for the next cut, secure with the set screws and continue with the turning.

The turning mill shown in Plate 3 is constructed largely of wood and consists of three principal members, the stand, template arm and the table. The top of the stand extends on one side to receive the template arm. The table is made of cross-grained one inch wood and is covered top and sides with galvanized iron. A 1½″ pipe flange is the means of connecting the table to the shaft which is a 1½″ pipe. Eight metal casters, placed at the centers shown in the plan view of the turning mill, act as a form of ball bearing to support the table.

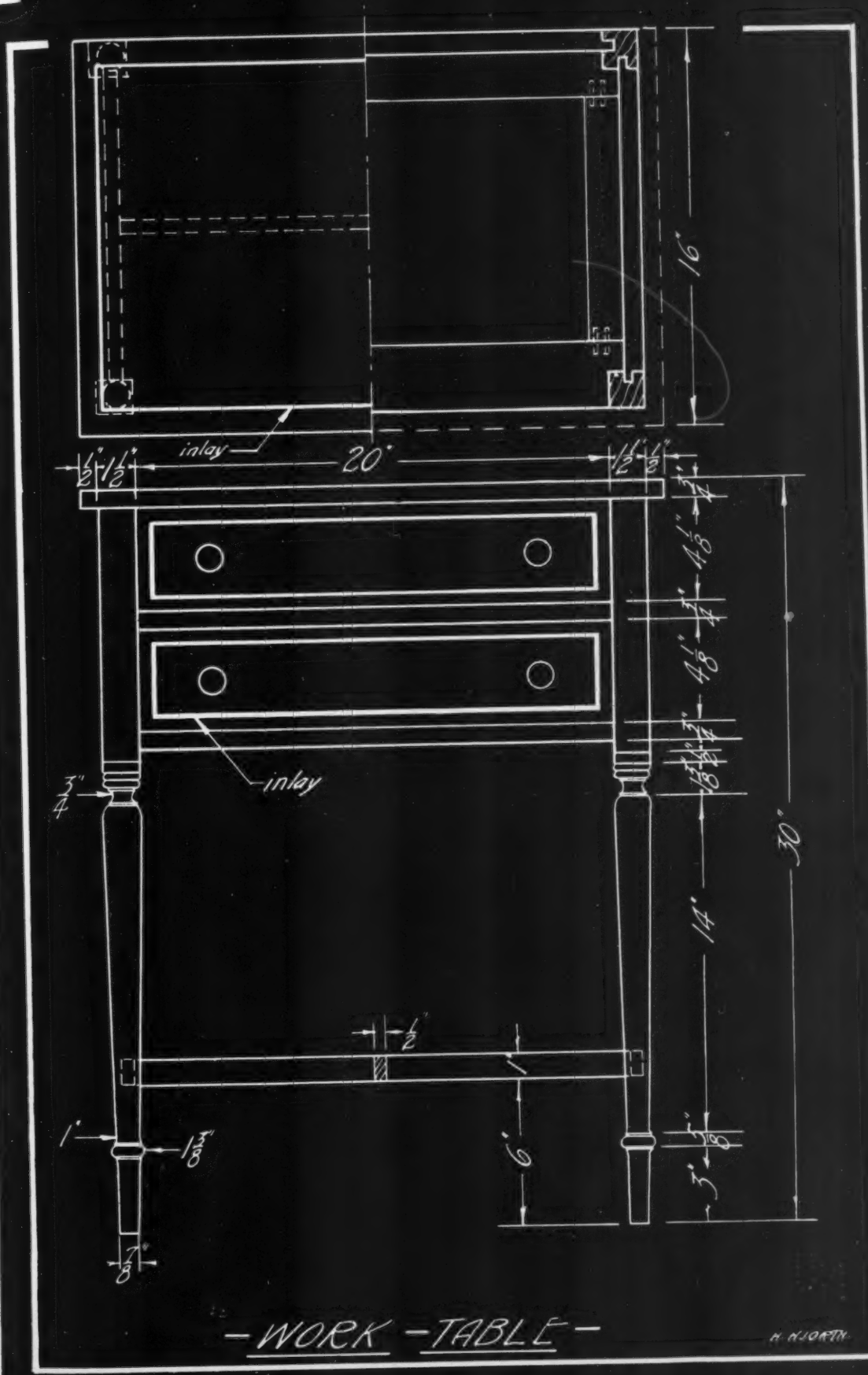
Drawing E, Plate 2, shows the form of tapering collapsible core used in turning the base part A and the two hollow pedestal sections B, C, Plate 1. It will be noted that the two halves of this core slip or snap together. When it is desired to release the core from the turned concrete section, which should not be done until the day after turning, bend back tabs marked (1) on the drawing E, Plate 2, at the larger end of the tapered core, take hold of the released corner of other half of core and draw out.

Drawing F, Plate 2, shows the basin mould which is supported within the stock supporting ring by a supporting disk. The basin mould is 17″ in diameter and 2½″ deep, and could be made by filling an ash can lid or metal basin of suitable proportions with concrete. Metal strips are first soldered at various points to the inside of this shallow dome to help bind the concrete.

The basin mould is supported upon a 13″ disk of ½″ wood. The stock supporting ring is made of ¾″ laminated wood cut to fit the basin mould and has an outside diameter of 23½″. All wooden parts must be water proofed with spar varnish and waxed before each use. It will be noted that when set up, a tapering solid core 3″ in diameter at the base, 2½″ in diameter at the top and 4″ long is centered upon the basin mould. When all parts have been assembled as shown in drawing F,



DETAILS OF TEMPLATES AND OF FOUNTAIN BASE.


16"
inlay
20"
1/2" 1 1/2"
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3/4"
inlay
48"
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14"
1/2"
1"
1 3/8"
7/8"
6"
3"
1/8"
-WORK -TABLE-
H. NJORTH.

WORK-TABLE

Herman Hjorth, San Juan, Porto Rico

The work-table illustrated herewith is the kind of small table that is so desirable in the modern home, because it may be used for a variety of purposes and is just as well placed in the living room as in the bed room.

It is so simple in construction that it may easily be made by eighth grade students. The chief points in the process of construction are briefly as follows:

After the four legs have been turned and their upper part squared, the sides, which are two boards ¾" thick, 9¾" wide and 13½" long are fitted into the legs as shown. If machinery is not available for cutting grooves and tenons, dowel construction may be employed. The small stretchers, 6 inches from the floor, are now made, so that they may be glued at the same time as the sides. The back is a board similar to the sides. The frames supporting the drawers are made as shown in the plan, the lower one having a dust-panel. The middle stretcher is made and fitted between the side stretchers, and the whole consisting of the two sides, the two frames, the back, and the middle stretcher is then glued together at one time.

The drawers are now made and fitted in place and the top screwed to two cleats fastened between the legs. For drawer construction any good textbook on woodworking may be consulted.

WORK TABLE

In this case the drawers and top are decorated with a fine line of satinwood inlay, which adds much to the attractiveness of the piece. The work of inlaying can be done very easily in the following manner: Buy the lines, which are about ⅛" wide from a firm specializing in marquetry work. Remove the steel point (spur) from an ordinary marking gauge and shape a piece of steel from a piece of an old hack saw or ordinary saw like the point of a ⅛" chisel (bevel on one side only). Fasten this piece in the marking gauge instead of the spur and try it on a piece of waste wood. File or grind until the little piece of steel cuts a groove of the proper width. The line of inlay should fit so tightly in the groove that it must be driven in by light taps with a hammer. It is advisable to wash off the surplus glue around the line of inlay—and for that matter around all glued joints—with hot water, because hardened glue dulls the cutting tools.

When dry scrape with veneer and cabinet scraper and sand until smooth. This table was made of solid mahogany, it was colored with a solution of bicromate of potassium, given a coat of wood filler, and finished with linseed oil. Consult any good reference book on the subject of wood finishing.

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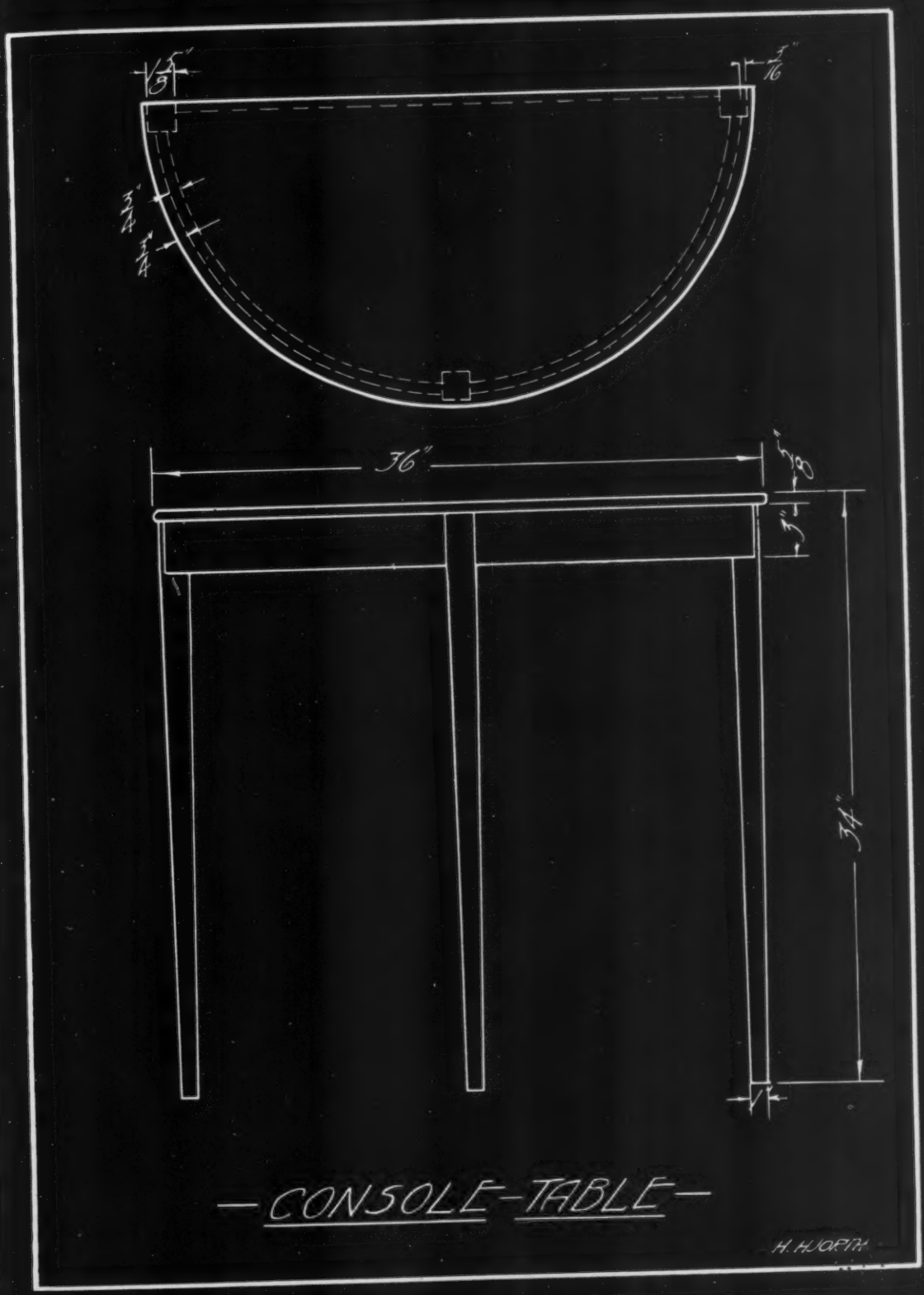
1/8"
1/16"
3/4"
3/4"
36"
5/8"
3"
34"
1"
—CONSOLE-TABLE—
H. HJORTH

CONSOLE-TABLE

Herman Hjorth, Director of Technical Work, Baldorioty de Castro Technical School, San Juan, Porto Rico

The console table, as stated above, is particularly adapted to a hall, but may also be used to advantage in a living room. Like the accompanying problem it is suitable for the 8th grade student on account of its simplicity of construction.

CONSOLE TABLE

A full-size drawing of the plan should first be made, so that a template for the curved apron may be cut. The two pieces, forming this part of the apron, should be cut on a band saw and may be sanded in a lathe if a sanding machine is not a part of the shop equipment. The legs and the pieces forming the apron are joined together with dowels. If a chain cannot be had for clamping, a strong piece of rope may be twisted until all the joints butt tightly against each other.

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Plate 2, and centered upon the turning mill, a retaining wall is placed around the stock supporting ring and the concrete is tamped in place. This retaining wall is just a strip of No. 22 gauge galvanized iron, 7" wide and long enough to snugly encircle the supporting ring and overlap three inches. It is tied with two hoops of iron wire.

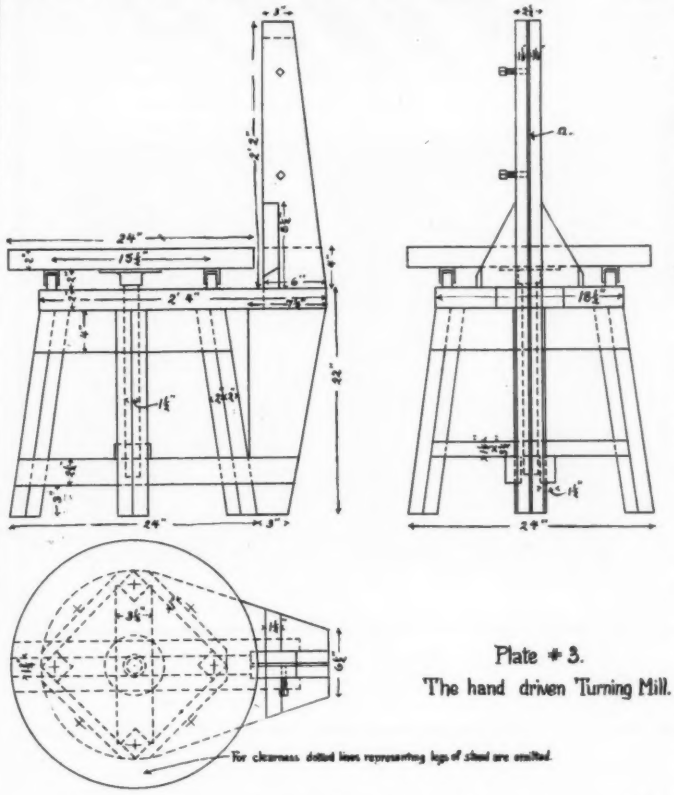


Plate # 3.
The hand driven Turning Mill.

A three-to-one mixture is made of sand and cement, both of which have been sifted through a sieve which has a mesh as small as twelve to the running inch. It is all important that concrete used for turning be free from aggregates larger than would pass through the sieve mentioned, and be also free from all other foreign matter. A bristle or chip of stone caught by the template would ruin an almost completed piece of turning. The mixture is made just moist enough that it can be squeezed between the hands without oozing water, retaining the shape it is thus forced to take. The mixture must be firmly and systematically tamped in place, using tamps of hard wood 1½" x 1½" x 15" cut square on the ends. If the slightest delay occurs during the tamping, the tamped surface must be scored to insure proper binding of the next quantity of concrete tamped in place.

From three to six hours is required for the mixture to set, before the retaining wall is removed and the turning started. For shapes similar to the base and the basin, three hours set is sufficient while for forms similar to the pedestal parts, four or even five hours set should be allowed, before the retaining wall is removed. The turning should be started as soon as the retaining wall is removed, unless experience indicates the stock is still too green (not sufficiently set) and the piece completed to exact measurements within the next one-and-a-half to two hours. After the basin is turned it may be sprayed with a little water a few hours later, and then let stand to further set until the next day when the basin mould is removed. To remove the basin mould, lift the turned basin by the supporting ring and remove the supporting disk. Now carefully lower again upon the turning mill or a nearby table, and tap the solid core lightly with a mallet, to loosen the basin mould which will drop down. The turned concrete basin still supported upon the stock supporting ring can be lifted free of the basin mould, and the solid tapered core removed. The turned piece is allowed to remain another day upon the stock supporting ring, during which time it is thoroughly wet several times with water from a sprinkling can. At the end of this period the turned piece is sufficiently cured that it may be handled without the help of the supporting ring from which it is now removed, and placed in a water tank for a week or more to completely cure.

In turning the other three pieces of the fountain the collapsible core is first centered, small end down, upon the turning mill table. This is surrounded by a retaining wall of galvanized iron of sufficient height and one inch larger in diameter than the finished piece. The concrete mixture or stock is then carefully tamped in place taking care not to move either core or retaining wall off center. The turning proceeds as outlined above, the core being removed the next day at which time the piece may be carefully removed from the turning mill and placed in the curing tank.

Wild Flower Designs

Article IV: Torn Paper

Nettie S. Smith, Smith Center, Kans.

The Sand-hill Sunflower. This is one of many varieties of sunflowers. The blossom itself is very nearly like that of the common sunflower, but the plant is much smaller and the leaves are of an entirely different shape. The rugged little specimen shown in Plate 7 bears the marks of some of the hardships it has withstood, yet it is an interesting illustration of the principle of harmony by radiation, and is valuable for its lines of beauty. The flowing, rhythmical lines radiate from a curved axis. Every line is related to the others, and the result is a beautiful unity. A plant presenting such graceful lines of growth expresses harmony to the eye that has learned to see it just as music is harmony to the ear that appreciates it. Some of the joy of making plant drawings is in discovering these lovely harmonies of Nature and then recording them for future use.

Tearing Floral Designs. What could be more delightful to anyone than to take a piece of paper and with no tools—only the two hands—to produce a beautiful decorative form? Simple pieces are so effective when laid on a contrasting color that this method is a great stimulus in the development of designs.

The Charm of Torn Edges. There is a subtle charm about a torn edge like fleecy cloud edges, water marks,

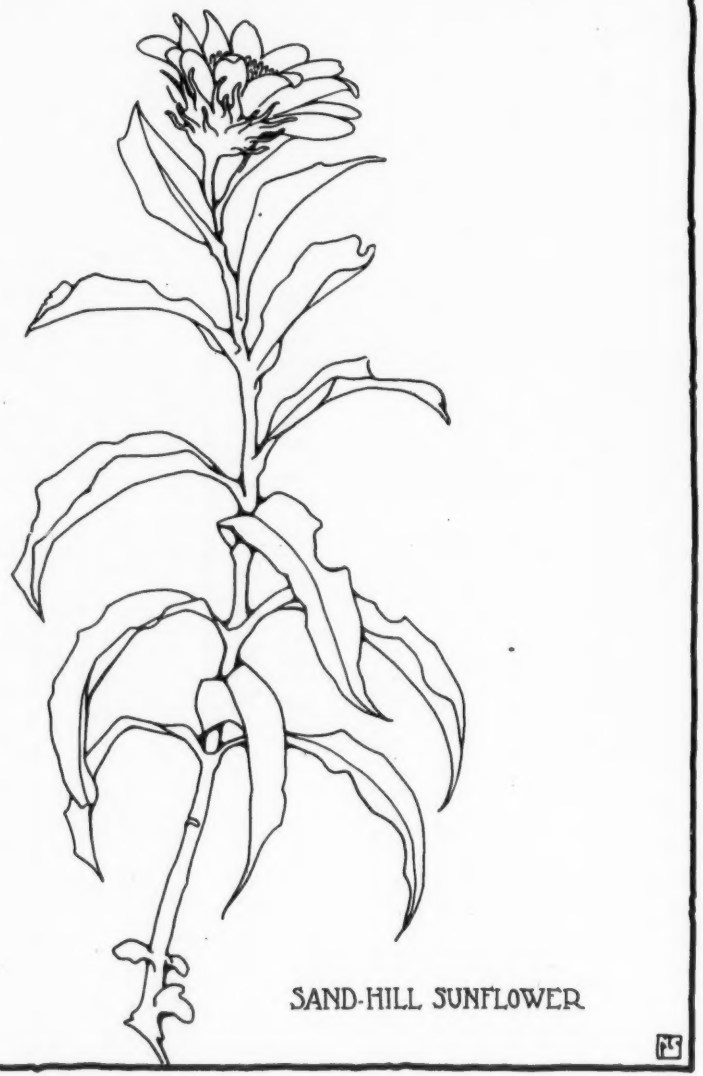


PLATE 7.

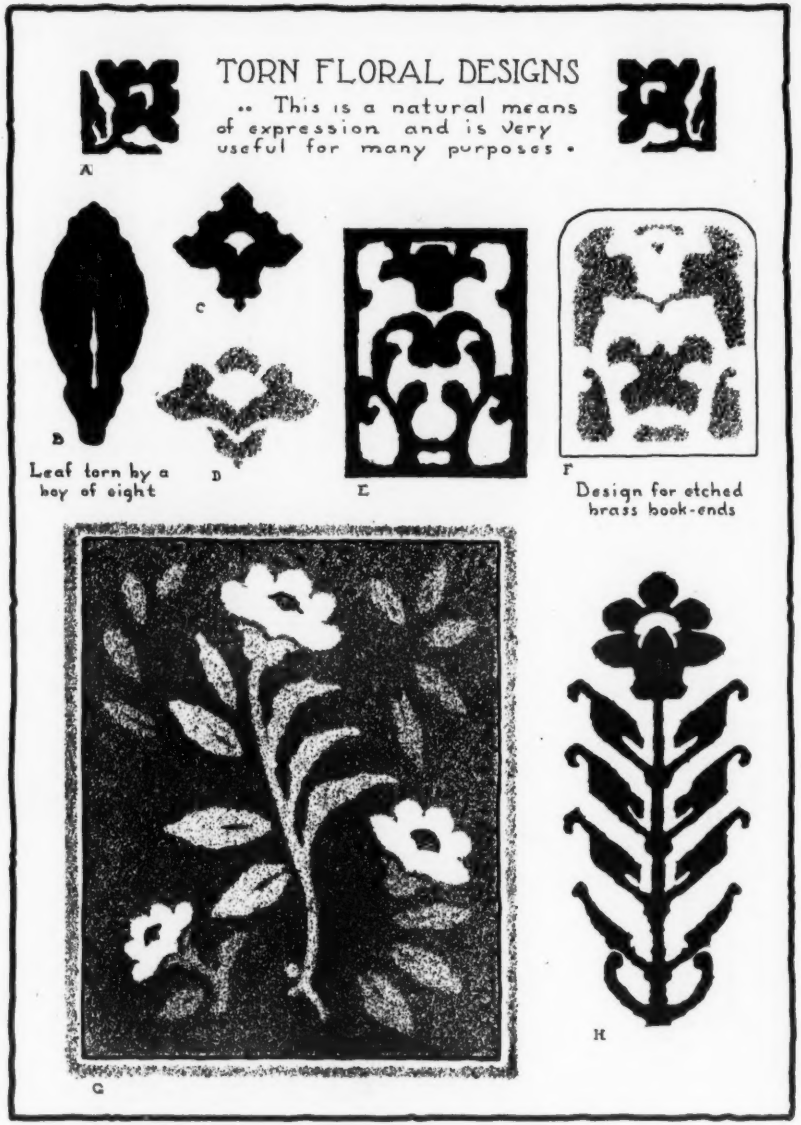


PLATE 8.

or atmospheric effects. There is an alluring mystery and fascination about it that is harmonious with plant forms, and a floral design that is torn out has a softly elusive quality that a cut design cannot have.

The Method. Paper that is easy to tear should be used. Blank newspaper and colored poster papers are among the best. The tearing is done with the thumbs and first fingers and can be controlled quite accurately with but little practice. It is well, at first, to follow a pencil line; but good results are gained by freehand tearing. (The directions given for cutting bi-symmetric units will be helpful for tearing also.) A great convenience in tearing designs is to have strips or pieces of paper the size the designs are to be. Measure the width and dot with a pencil, then lay a ruler flat on the paper and press firmly against the table with the left hand while pulling the paper up with the right. This gives a straight, torn edge.

Uses. Torn paper designs may be used by pasting the motifs onto paper of contrasting tone or color. Another way is to use the torn pieces with spatter work. Designs developed by means of paper tearing may also be adapted to many other mediums such as block-printing, tooled leather, wood carving, pottery, metal work, or embroidery, according to the need.

Description of Plate 8. A is a naturalistic motif torn from a square of paper. Such designs can be used effectively in mottoes, posters or with panels of lettering. If they are to be used in pairs, the two can be torn at once.

B is an interesting leaf form torn by a child of eight.

C is a bi-symmetric unit made by folding a square on the diagonal and tearing out two bits on both edges and one in the center.

D, another sunflower motif torn on a fold, shows the effect produced by using the surrounding piece as a stencil for spatter.

E is a floral design suitable for the decoration of a box or book cover. The design was torn from dark paper and pasted on a light color.

F was planned for etched brass book ends.

G is a decorative panel in spatter tones. This was made for a small serving tray using yellow, yellow-green, green and black.

H is a formal ornament emphasizing the symmetry and unity of the plant.

Foundations. A few pencil marks as foundation are a help in giving purpose and plan to designs. Anyone can make interesting, original shapes by paper tearing and a knowledge and use of the elementary laws of composition will insure order and beauty in the forms produced.

LITTLE ARGUMENTS ON GREAT PRINCIPLES

Subjects and Courses

"I notice that you are quoted in the morning paper, Mr. Frills, as advocating that Art be made a required course of study for all pupils in the high school.

"How can you defend such a statement in view of the crowded curriculum of our schools? It seems to me our boys and girls are studying too many subjects now. They go from class to class getting a little of this and a little of that, without time or opportunity to study anything seriously. I would be in favor of fewer subjects of study and more study of subjects."

"No! They miquoted me, Mr. Try Square. I did not advocate that Art be made a required course of study in the high school; but I did tell the reporter of The Morning Dial that Art should be studied by every pupil in every school because every man, woman and child has constant use of Art in their daily life and work!"

"Well! Your distinction between a subject of study and a course to be studied seems to be a distinction without a difference.

"As for Art! I have got along fairly well without it. When it comes to a choice between pictures and reality, I prefer the reality and would far rather have a farm of forty acres than any picture of forty acres ever painted by any artist.

"In fact, I have never seen a picture of anything to eat, drink, wear, or use that I would not trade for the reality. How can you say that any picture is more valuable than the thing it represents?"

"Again you misquote me, Mr. Try Square. I did not say that pictures are more valuable than the reality they represent, though I might show you pictures of many valuable things that are more valuable in dollars and cents than the things they represent. Art is a commodity the value of which can not be measured in dollars and cents. Art is the emotional expression of the artist and of the race. Art measures the accomplishment of humanity.

"You say, Mr. Try Square, that you have got along fairly well without Art! I say you have expressed yourself as an artist of distinction.

"I saw you only this morning pottering around in your beautiful back yard with trellises and vines and flowers, painting your picture with a rake and a hoe and a lawn mower. To be sure you used a pruning knife in place of a palette knife and you used a garden hose for a brush, but you trimmed and shaped and planned your back yard picture according to your ideal, or as near to it as you could, and it seemed to my trained artistic eye your own, charming, individual creation.

"I beg of you, Mr. Try Square, do not spoil my conception of your artistry by telling me that you were working for wages or fixing the place up to sell. I prefer to think of you as an artist, and I am ready to defend my statement in the morning paper that every subject of study in the schools should be an influence toward making artists.

"As for a course in Art—well! the art teachers seem to vary some in their plans and purposes. I fear the subject of Art has not yet been formulated and standardized to the point of relieving the other teachers of part of the obligation of teaching Art. Even the teacher of Manual Training must assume some of the burden."

INDUSTRIAL-ARTS MAGAZINE

E. J. LAKE S. J. VAUGHN
Editors

MISTAKEN NOTIONS AND THEIR ANTIDOTE

Those who champion a particular interest are kept quite as busy denying misconceptions as they are in emphasizing the purpose of their interests.

Art as a school subject, is in the minds of many laymen and some educators, the evidently impossible attempt to develop school children into painters, sculptors and designers.

Manual Training as a school subject, is in the minds of many laymen and many educators the attempt to train boys and girls to do carpentry, metal work, and chores about the house without calling in the tradesman.

Vocational Education as a school subject is considered by some as vocational practice in a kind of employment to which the school boy and girl has been committed for life to make a living.

These mistaken notions are held by many because those responsible for the planning and instruction in these subjects are not competent.

These subjects are in the theoretical stage. No one knows just how to teach them best but every teacher must have a creed. Every teacher of Industrial Art should have a well considered purpose constantly in mind as a guide to effective instruction. Why do I teach Art? Why do I teach Manual Training? Why do I teach a Vocation?

I teach Art because I know that every individual finds the constant need of appreciation and choice of beautiful and appropriate commodities and the constant need of self expression.

I teach Manual Training because I know that every person should have understanding and appreciation of structural device as applied to materials and tools by which people produce the commodities.

I promote vocational incentive in the education of children because I know it is a strong incentive to good citizenship and helps the child to discover and apply his abilities for the common good.

I teach to develop the individual to the best capacity which his personal conditions and equipment will allow. I believe that teaching is a worthy and responsible profession in which I hope to become proficient.

WHAT HAS THE SUMMER DONE FOR YOU?

Some teachers have attended summer schools. Others have worked at trades. Still others have continued their teaching. A few have been fortunate or unfortunate enough to take the entire summer as a vacation. A very few have traveled.

The question is, "What influence will the summer's work play, business, or study have on this fall's teaching?" It certainly would be a calamity to say that it will have no influence and that the teaching will be on exactly the same plane as that of last year.

Teachers, like other people, either go forward or backward. They do not stand still professionally. A summer's work in a good school should give one a new point of view, or it may give a new conviction and a new force to an old point of view. It may suggest a new method or the modification or improvement of an old method. The experiences gained in trade work or vacation or travel should send the teacher back to his professional duties with greater enthusiasm and greater determination to do a superior piece of instruction than ever before in his life.

The teacher who goes back to his task simply with the idea that his scheme or system is already perfect and that he can simply drift along with the same old course, the same old method, the same old lists of references, and that he can teach in the same old way, will suddenly find out that he cannot even teach in the "same old way," but that he has slipped back.

At the beginning of each year, at least, every teacher should rethink his way through his entire scheme or philosophy, should replan his outlines, restate his course of study, replace his emphasis if necessary, and rejuvenate his youthful spirit. Teaching and thinking can never static things. They must change and advance and *grow*. Only in this way can they retain a freshness, a vigor, and an interest in the things upon which the youth of the land must depend for their ideals, their guidance and their progress. May the summer have made some such contribution to every teacher.

HURRAH FOR THE SCOUTS

We have visited a scout camp this summer where teachers might find suggestive methods of instruction. A camp of sixty young Americans going through a daily program of work and play under the direction of two scout masters, who have had a change of classes every two weeks for the past several summers.

In this time these two masters have developed hundreds of boys from puny, dependent, home-grown egotists into virile, independent youngsters who could do a fair job of wood craftsmanship with confidence; could swim like ducks; dive like loons; save life in the water; splice ropes like a sailor; keep a tent in order; describe and tell the habits of many birds and animals; draw a good map of the camp and the surroundings; signal from one hillside to another; wash dishes, serve table and say grace.

With all of these accomplishments it must be noted that the boys have a good time. The name of the camp is Hatetokwitit. Many fond parents visit the camp to see if their precious offspring is treated according to home standards. Johnny usually settles the point by begging to stay another two weeks. He hates to quit it.

The parents are taken into confidence by the boys and led on a winding path through the woods to a wonderful "Mineral Spring." It is a mineral spring all right. One the boys found discarded from a piece of farm machinery and placed in a snug hole in the ground. "Darwin's Pride" is another surprise at which visitors are allowed a peep. This eighth wonder of the world is composed ingeniously of the bones of various animals the boys have foraged from the hillsides. Youth will have its fling and fun at the expense of age and wisdom. The wisdom of age is expressed by entering into the spirit of camp Hatetokwitit.

After a few hours in camp the parents hate to quit it.

Who ever heard of Johnny begging to have school last two weeks longer? Who ever saw Johnny develop so much physically, mentally and morally as he did in that two weeks at a scout camp?

Hurrah! for the scouts and the scout masters. They have found the fountain of youth. They have acquired the spirit of The Industrial Arts.

TRYOUT COURSES

The quite noticeable reaction against the so-called tryout courses is probably due to the exaggerated claims made for such courses by their enthusiastic sponsors. That any course in any subject, when properly conceived and properly conducted, has in it a prognostic element is scarcely to be disputed. But to contend that a few weeks' contact with a life occupation in a sort of dilatante, playful way furnishes sufficient basis for a life choice is hardly to be thought of by any one familiar with the actual problem of vocational education. What makes the matter still more disconcerting is the fact that so large a number of those who are trained in the vocational and professional schools fail to follow the occupations for which they are presumably well trained. If a complete course of several years in a vocational or professional school fails in its tryout values, it is not to be wondered at that the general industrial arts courses in the elementary and junior high schools fail in such values.

There are so many indeterminate quantities in connection with young people. There is, of course, the problem of the inherent capacities, which is thus far not a matter of definite knowledge. The element of temperament, the conditions of environment, the question of parental occupations and ideals, the social background and training, the physical adaptability, and a score of other more or less intangible things enter as factors in the determination of life choices and life occupations.

The fact of the matter is that at best the efforts, the schemes, the plans and the devices for the predetermination of one's future work will probably never approach the realm of an exact science. Along with astrology, phrenology, and alchemy, the exact prediction of one's future success in certain callings bids fair to remain the fascinating art of the fortune teller and the conjurer.

Life would lose a good deal of its fascination and its zest, if it could be accurately charted and blue printed for the individual person. The human element always remains. The quest of the unattainable will always have its lure. The surprises of life and its paradoxes keep many a man on the upgrade with teeth clenched and heart determined. To many a man his life has been an incomparable success when to the world at large and according to the standards and the analyses, it has been an unspeakable failure.

However, the fact remains that there are certain tryout values and tryout principles discoverable in all work. How to determine the values, utilize the principles, and organize the courses for guidance purposes is a problem not yet solved. So far as the elementary and junior high school industrial arts work is concerned, probably its greatest value will always be its contribution to the general education and its furnishing of varied experiences that will function as bases for judgments and choices to be made somewhat later in life.

GET ON THE JOB EARLY

The teacher, especially the new teacher, who fails to get on the job early this fall loses his first great opportunity of the year. There are a million things for the shop teacher to do before he can do justice to his pupils or his work that the teacher of general educational subjects do not have to worry about.

At the close of school in the spring, the tools were all properly stored in such a way as to assure safety and to prevent them from rusting, etc. Or *were* they? The assumption is that every good teacher leaves his shop in order and his tools in good condition and properly put away for the vacation. This being the case, a good deal must be done to get the tools out of storage, get them with proper edges, see that they are properly marked, and arrange them for actual work. Also the question of the delivery and storage of materials and supplies is an important one in many places. In larger cities, such material and supplies, etc., are attended to earlier in the season and by others than the teachers of the shop courses. But, in moderate size towns many of these items are not attended to until the teacher gets on the job in the fall.

It is perfectly true that, in many places, the classes in shop work do not meet the first week, leaving the shop teacher free, presumably to care for all those matters of equipment, supplies, etc. However, if the shop teacher is wise, he will want to visit the schools from which his students are to come and to come in contact somewhat with the students and their teachers before they ever come to his shop.

Hence, we close as we began, with the suggestion that shop teachers get on the job early and stay late and work at it strenuously from the first bell in September to the last one in June.

Farm Shop Objectives

Louis M. Roehl, Ithaca, N. Y.

The purpose of the following statement of Farm Shop Objectives is to point out what appear as the outstanding goals in training boys for the mechanical work in the farming occupations.

Neither the kinds of work nor the aims listed under each kind are placed in order of their importance or in the order of offering them in the school curriculum. Observation on the farms and consultation with farmers of a community should be of aid to the teacher in deciding their relative importance in the shop course and also in selecting problems for work.

I. Carpentry

1. To be able to perform all the carpentry tool operations in a workmanlike manner and to apply them to all ordinary farm repair and construction work.
2. To know lumber well enough to make such a selection for any farm need as is made by the carpenters of the community.
3. To make out and figure up a bill of material for such construction work as farmers find it profitable to do.
4. To fit handles in farm tools, viz.: hammers, sledges, axes, forks, shovels, etc.
5. To know enough about builders' hardware such as nails, screws, bolts, hinges, rivets, door fastenings, etc., to make a wise selection for any purpose and know how to attach it.
6. To be able to cut glass to size and knead putty and properly place a window pane.

II. Painting and Paint Brushes

1. To be able to clean and care for paint brush.
2. To properly prepare a surface for painting or varnishing.
3. To know how to properly mix the ingredients commonly used by painters in preparing paint and apply the paint to buildings, farm vehicles, machinery and portable appliances.

III. Metalworking

1. To fit the farm saws (including the circular cordwood or buzz saw if it is used in the community).
2. To solder utensils used on farms such as milk cans, pails, etc.
3. To use hack saws, files, cold chisels, punches, metal drills, taps and dies, and other hand tools in a workmanlike manner in overhauling farm machinery and keeping other farm equipment in good condition.
4. To grind all edge tools used in farming.
5. To know how to build and keep a good fire in a forge and properly shape and temper farm tools such as pickaxe, mattock, grub hoe, cold chisels, punches, harrow teeth, etc., and to do such other elementary forge work as may be useful in overhauling farm machinery.

IV. Harness Repairing

1. To clean and oil a harness.
2. To be able to make harness thread and do stitching.
3. To do all the ordinary repair jobs such as putting in a new hame staple and hame clip and putting on all ready-made repair parts.
4. To be able to fit or adjust a harness to a horse.

V. Rope Work

1. To be able to splice a rope used in hoisting hay.
2. To be able to make a rope halter.
3. To reeve a set of block and tackle and figure the mechanical advantages of single, double and triple blocks.
4. To be able to tie the common knots and hitches which farmers find useful and apply them to farm use.
5. To know kinds of rope suited to farm use and sizes desirable for specific purposes.
6. To know several ways of finishing ends of rope.
7. To know how to care for rope.

VI. Concrete Work

1. To know how to build forms for walls, floors, mangers, walks, curbs, milk house, etc.
2. To test gravel and sand for cleanliness and know mixtures suited to particular purposes.
3. To be able to mix, pour and trowel a construction job in a workmanlike manner.
4. To do a repair job in concrete that will hold.

VII. Agricultural Drawing

1. To be able to read such drawings as pertain to farm appliances, farm architecture, and mechanics.
2. To be able to make working drawings of such appliances as farmers find it profitable to make.
3. To be able to make freehand sketches of details of construction.
4. To be able to make rough drawings of floor plans of farm buildings so as to make clear to carpenters, contractors or architects what is desired.
5. To arrange the layout of farm buildings and fields so as to provide economic use of labor.

VIII. Field Machinery

1. To know how to operate and make all the adjustments on the implements and machines which are used on the farms of the community.
2. To sense the desirability of properly caring for and housing all farm tools and machinery.

IX. Power Machinery

1. To be able to make all the ordinary operating adjustments and do the repairing jobs connected with gas engines, viz.: adjust carburetor, clean spark plugs, clean out carbon, grind valves, change oil and grease, and adjust bearings.

X. Belt Lacing

1. To know the different kinds of belts and the kind of work for which each is suited.
2. To know one good way to lace each kind of belt used in farming.
3. To know how to operate and care for belts.

XI. Plumbing

1. To know pipe sizes and kinds of pipe fittings.
2. To be able to cut, thread, and ream a pipe.
3. To be able to repair leaky faucets and valves.
4. To know how to operate and care for a water system for a rural home.

XII. The Farm Shop

1. To be able to select and care for the tool equipment suited to the needs of any particular farm.
2. To be able to build a workbench, saw horse, and other necessary shop equipment.
3. To arrange the equipment and tools so that farm construction and repair work can be done with greatest convenience.

THE RIGHT WAY TO SOLDER

C. C. Hermann, Moline, Illinois

Preparing the Bit; Other Equipment

The most common mistake in soldering is the use of a bit too light for the work. The bit, to work well, must be of sufficient weight to hold the heat a reasonable length of time. If the work is of good size, it is advisable to work with two bits in the heat. The bit for average soldering should weigh four or five pounds and should be made of a good grade of copper. If the bit is too light, frequent heating will be the rule and the joint will be difficult to obtain.

Copper bits must be tinned before using. This consists in applying a thin coating of the solder over the point of the bit. To accomplish this, the bit is heated in a charcoal or gas flame. A soft brick is obtained, and after the bit is heated, it is filed back and forth on the surface of the brick until thoroughly cleaned of all oxidation. All flats of the bit are thus cleaned for a distance of about one inch back from the point. The point is then rubbed on a piece of resin and then on a piece of solder until the surface is well tinned. Before allowing the bit to cool, wipe the tinned surface with a heavy piece of canvas. Another way to tin the bit is to sprinkle some resin over the solder and then rub the bit on the solder. In this way the resin will flux the surface of the bit and the solder is taken at the same time.

Considerable care must be exercised in heating the bit preparatory to tinning, and thereafter during soldering. If the bit is heated at too high temperature, the heat will oxidize the surface, making it impossible to tin the tip. The proper temperature of the bit may be readily ascertained by watching it heat. When the proper temperature is obtained, the gas flame surrounding the bit will take on a greenish hue. Remove the bit from the fire as soon as this change in the flame color is noticed, otherwise the tool will very likely be heated in excess and tinning cannot be accomplished.

Before leaving the matter of tinning the bit, I want to call attention to a second method which I have used to advantage. This consists in placing a few drops of solder on a block of sal-ammoniac and then rubbing the heated bit in the solder. The sal-ammoniac forms a flux over the bit, providing a ready adhesion between the copper and the solder.

The question often arises regarding the condition that a bit is in, requiring re-tinning. Re-tinning generally results from over-heating the bit. Otherwise it is rarely necessary but once, unless the bit develops pits in which case the point must be re-worked, necessitating re-tinning. When a bit is heated at too high temperature a yellow powder forms over the point of the bit. It must then be tinned by one of the preceding methods before work can be resumed.

Should the bit assume a pitted surface, the point may be dressed by filing away the pits, retaining the general shape of the point. It must then be tinned before use.

The soldering iron may be heated in almost any kind of a fire; however, the gas furnace is the most serviceable way. It is handy, quick, and cheap. For the workshop, where the soldering is done in the shop, only the stationary furnace using city gas is preferable. For field work such a furnace would not do because of the necessity of attaching to a gas supply. In the latter case, a gasoline blow torch is the preferable method of heating. A small charcoal heater is also a desirable method for field work.

In the use of the gas furnace for heating the bit, care must be exercised to obtain the correct proportion of gas and air. A blue flame is the only requirement. The lack of air will result in a yellowish flame which throws out a lot of soot. This soot collects on the bit, causing difficulty in soldering. In case there is an excess of air present, the flame will be low heat and probably be extinguished entirely. In the event a soft coal heater is used, the bit must be protected from the fire by the use of a piece of sheet steel.

(To be continued)

The Composition of Business Stationery Forms

Robert F. Salade

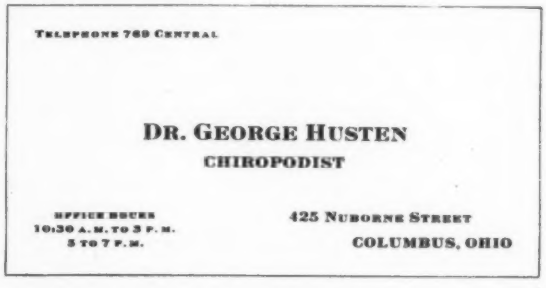
(Concluded from August)

Harmony in business stationery is possible, even when each form consists of only a few lines of type and the typography is exceedingly plain. One example of this would be a letterhead form set in small sizes of Engravers' Bold. The same face of type in various small sizes can be used for the note-sheet, billhead, statement and envelope. As a matter of fact, this idea is being followed in many instances with pleasing results.

When business stationery is to be printed from type in colors, there should be harmony in the color scheme as well as in the design of the forms and the face of type selected. To illustrate: A letterhead form was set in Cloister Bold in such a manner that the completed form had a shape somewhat like an inverted pyramid. A small type ornament, which was also like the shape of an inverted pyramid, was placed at the foot of the typographical form, and this carried out the complete "pyramid" to a nicety. The type-matter portion of the form was printed in bronze green ink and the ornament was printed in bright red. The same color scheme, and the same pyramid arrangement of type-form, were followed for the note-sheet, billhead, statement and envelope, thus establishing a perfect relationship of design between all the different pieces of stationery.

The above example may be elaborated on to any degree. A simple two-color design was mentioned to illustrate harmony in both type and color scheme. The letterhead should be regarded as the most important member of the business stationery "family," and from it the typographical style and color plan should be adopted for the note-sheet, billhead, statement and envelope. In many instances, a business card for a firm may be designed after the style of the firm's stationery, especially in cases where all of the stationery is printed in the same color scheme.

Imitation engraving and lithographic processes of different kinds are being used in the production of business stationery with more or less success. Several of these processes are patented, and by the use of special printing ink, chemicals in powder form, and heating treatment the printed form is given a raised effect which looks much like die-stamping, or embossing, from engraved steel plates. The other processes are more simple, consisting merely of specially-made printing ink which drys with a soft, dull finish, and careful make-ready which does not show impression. That is, the impression is not noticeable on the back of the printed sheets.



A BUSINESS CARD OF THE DIGNIFIED STYLE APPROPRIATE FOR THE MEDICAL PROFESSION. COMPOSITION IN CARD LITHO SERIES.

HARMONY IN BUSINESSS STATIONERY.
Examples taken from American Type Founders Company Specimen Book. Faces of type used: Comstock, Condensed Comstock, Caslon Oldstyle No. 471 and Italic. "Hello" stock cuts.

The type-faces most effective for imitation steel-plate work are: Engravers' Roman, Copperplate Gothic, Engravers' Bold, and other faces of this variety. The faces most adaptable to imitation lithography are the gold gothics and the Litho Roman series. In many cases, however, of forms for either imitation engraving or lithography, a happy combination of light and bold faces can be made, such as Litho Bold for the principal lines and light Copperplate Gothic for the secondary lines. A letterhead form or a business card form often looks well with a combination of these two faces.

Shaded faces and "open" faces of well-known designs of type very often may be used with beautiful effect in the composition of stationery forms intended for imitation steel-plate engraving or lithography. A new Caslon open face, especially when used in the larger sizes, is pleasing for this class of work. The most popular shaded faces are Title Shaded Litho, Engravers' Shaded, Copperplate Gothic Shaded, Steelplate Gothic Shaded, Engravers' Roman Shaded, Lithograph Shaded, Antique Shaded and Bodoni Bold Shaded. Numerous other faces of the shaded variety are supplied by the leading type-founders.

When using a shaded face, the main lines should be set in the shaded while the smaller lines may be set in such types as Copperplate Gothic or Engravers' Roman. The shaded and "open" faces must be handled and used with care as these are easily damaged by reason of their fine lines. When the larger sizes of these faces are distributed in the cases, it is a safe plan to stand the characters upright in the compartments of the cases rather than to "throw in" the type in the ordinary way, as this prevents the delicate lines of the characters from coming in contact with one another. Care must also be exercised when taking proofs of a form and when planing down a form containing the shaded or open letters.

The standard faces of script type are frequently used in the composition of stationery forms, and where imitation engraving or lithography is wanted. And, of course, the newer script types may be used for stationery forms to be printed in the usual manner. A bold script is often just the thing for stationery forms used by banks, trust companies, and insurance firms. As a general rule, when script type is selected for the composition of a form of any kind, no roman faces of type should be used in combination with it. But, in the case of a letterhead or business card to contain names of the officers of a company, and telephone numbers, such lines may be set in small sizes of a face line gothic while all the other matter is set in script. Two different faces of script seldom look well when used in combination.

In the composition of a stationery form, which is intended to suggest the engraving or lithographing effect, the typographer should first make a careful choice of a series, or combination of series, which will be most suitable for the character of business to be represented. The type should then be set with rather narrow space between words. The average space between words in this class of work is the 4-em space of the size of type used for each line. The steel-plate engravers and lithographers, when designing stationery forms, usually space very close, and this is the effect to be produced by the type compositor. Wide spacing is not the right thing for good typography of any variety, but it is totally out of place in a neat stationery form. The spacing between lines should also be somewhat close, as to each group of type-lines in a form, but sufficient "white" space is to be placed between the various groups. Upon the completion of a form the compositor should take a proof of it, and should then study the entire arrangement for the purpose of determining the correct amount of space between lines. Often, by transferring a lead here and there, or by adding or removing a lead, the compositor can accomplish a remarkable improvement in the entire appearance of the form.

Because of the fact that the typewriter is now used for the writing of nearly all letters, note-sheets, bills and statements, ruled lines for the date and customer's name are not often inserted in forms of this class. This is more true of letterheads than of bills and statements. Very few letterheads or note-sheets are now printed with the old-fashioned date line like "New York City..... ...., 192...." The present style is to place the name of the town or city at center with the main mass of type matter, like this example:

WILLIAM W. WILSON
House Painter and Decorator
432 Fulton Street
New York City

The present day note-sheet form is set in this same style, with no rule line printed for the date. The date is simply written with a typewriter (or with pen and ink, for that matter), in the blank space at the extreme right of the main mass of type.

The present styles of billhead and statement forms are composed much like the style of the plain letterhead form printed above. This is especially true of the class of forms used by doctors, dentists and other professional folks. The name and address of the debtor is typewritten in the blank space to the left of the printed form, and rule-lines are not needed for this typewriting. However, many forms for bills and statements are still being

printed in the old way, with rule-lines for the date, name and address of the debtor, and in some cases dotted brass rule is used for printing these blank lines, while in other instances "hair-line face" rule is used. The "hair-line face" rule makes a better appearance with most forms than dotted rule.

The greater number of forms for bills and statements are now being printed on *unruled* bond paper, instead of on ruled writing paper as in the past. The compositor must keep this fact in mind when setting the type for such forms that he may provide dividing rules and other rules when necessary. In many cases of modern billhead forms there is merely one long rule, or parallel rule, extending across the form, and dividing the printed form off from the lower blank portion of the sheet. Numerous statement forms are set in the same way. In other cases of both billhead and statement forms there are several rules, placed at right angles to the horizontal rule, and extending down on the blank portion of the sheet, in account book fashion. Numerous forms of this group are also composed in such a manner as to have ruled lines running both ways on the lower portion of the sheet, thus providing a ruled section for an itemized account like that seen on a regular ruled billhead or statement.

When a "cross-rule" section is to be set up and printed, the compositor can make up two separate rule forms for this, to be worked "double" in the same chase.

TOOLS	TOOLS.	1ST PERIOD	CHECKS
1. BEVEL.	24. TIN SNIPS.	1. HARRY HEIB	1. (1)
2. AUGER BIT.	25. COPING SAW.	2. JUNIOR COLE	2. (2)
3. DRILL BIT.	26. CROSS-CUT SAW.	3. GEO. BROWN	3. (3)
4. SCREWDRIVER BIT.	29. RIP SAW.	4.	4. (4)
5. BIT BRACE.	30. TURNING SAW.	5.	5. (5)
6. BELLOWS.	31. CABINET SCRAPER	6.	6. (6)
7. BURNISHER.	32. NAIL SET.	7.	7. (7)
8. OILER.	33. SAW SET.	8.	8. (8)
9. CABINET CLAMP.	34. FRAMING SQUARE	9.	9. (9)
10. HAND CLAMP.	35. YANKEE DRILL	10.	10. (10)
11. COUNTERSINK.	36. HAND DRILL	11.	11. (11)
12. DEPTH GAUGE.	37. EXPANSION BIT.	12.	12. (12)
13. WING DIVIDERS	38. MORTISE GAUGE	13.	13. (13)
14. FILES.	39. HACK SAW.	14.	14. (14)
15. RASPS.	40. PIPE WRENCH	15.	15. (15)
16. AUGER BIT FILE.	41. MONKEY WRENCH.	16.	16. (16)
17. HAMMER-CLAW	42. CALIPERS-INSIDE.	17.	17. (17)
18. HAMMER-PEEN.	43. CALIPERS-OUTSIDE	18.	18. (18)
19. DRAW KNIFE.	44. BIT CHUCK	19.	19. (19)
20. SPOKE SHAVE.	45. S. WRENCH	20.	20. (20)
21. PLANE-CIRCULAR.	46. PINCH BAR	21.	21. (21)
22. PLANE-JOINTER.	47. FACE PLATE	22.	22. (22)
23. PLANE-COMBINATION	48. CHISEL	23.	23. (23)
24. PLANE-RABBET.	49.	24.	24. (24)
25. PLIERS.	50.	25.	25. (25)

TOOL CHECKING SYSTEM.
Cards containing the Names of Students for the Second, Third, and Subsequent Periods are hung over the List of the First Period.

Materials
1 Piece ¾″ x 18″ x 23″.
2 Pieces 1″ x 1½″ x 25″.
2 Pieces 1″ x 1½″ x 20″.
3 Pieces ¼″ x 1½″ x 18″.
Divisions, 8″—8″—5″—3″ apart.
Line Spacing, $\frac{5}{16}$″.

HENRY CONKLIN DANIEL BEARING

THE AKRON MINING & MILLING CO.

DEVELOPING AND OPERATING
MINING PROPERTIES, TIMBER TRACTS
AND COAL LANDS

MAIN OFFICE
MANDRAKE BUILDING WASHINGTON, D. C.

A GOOD EXAMPLE OF A BUSINESS CARD.
Composed in Heavy Copperplate Gothic Condensed. Note how this face of type expresses the character of the business.

The stock for the job is cut double the regular size, but only *half* the number of sheets required are cut; for after the pressman has printed the sheets a second time for the purpose of completing the "cross-ruling," each sheet contains two complete pieces. When dry, the printed sheets are cut apart and then the full quantity for the order is procured. This is often called "wax-rule" work in the trade, after the electrotyping process of that name. All of the rules in the form join perfectly because the lines have crossed in the printing. The first form for a job of this kind contains the type matter and "down-lines." The second form contains all of the "cross-rules."

A SUCCESSFUL CHECKING SYSTEM

E. H. Funk, Industrial Arts Instructor, Fairmont, West Virginia

It has always been a problem in checking up on the tools in our shop at the end of each class period, and to overcome this a checking system, as illustrated, is being used to simplify matters, to save time, and to eliminate a great deal of trouble.

Previous to this, we used a similar system and permitted the students to carry their own checks and present them at the window of the toolroom, when in want of tools. The checks were then placed on the panel board underneath the tool used. This was a poor method, because checks were often lost, and also duplicated. This process was very inconvenient for the tool clerk as well as for the students.

By this new method, a new tool clerk has charge of the tool room each week, and he checks up with his predecessor and accounts for all tools. The tools are placed on a panel board in a given place which is convenient and also easily accessible.

The tool clerk, when asked for a tool, takes a check with a number corresponding to the boy's given number, and places it on the hook corresponding to the name of the tool used. Each student is allowed five checks, hence offering the use of five different tools. Due to the fact that the checks never leave the tool room, no trouble is encountered with loss of checks.

The tool clerk can see at a glance just who is responsible for the tools and for their return. If the responsible person does not turn in a tool used, the tool clerk must report to the instructor and learn of its whereabouts. At the close of the period the tool clerk reverses his method and takes the check from the hook describing the tool used and puts it on the hook corresponding to the owner's name and number. As a new class starts, the cardboard, upon which the names of the students in the second class are, is hung in the period column, and the same plan is carried out. The changing of cards enables the use of the same checks for the various classes.

PROBLEMS & PROJECTS

This department aims to present a wide variety of class and shop projects in the Industrial Arts. Successful problems are invited and will be paid for. A brief description of constructed problems, not exceeding 250 words in length, should be accompanied by a good working drawing. The originals of the problems in drawing and design should be sent.

Problems in benchwork, machine shop practice, turning, pattern-making, sewing, millinery, forging, cooking, jewelry, bookbinding, basketry, pottery, leather work, cement work, foundry work, and other lines of industrial-arts work are desired for consideration.

SPORT MODEL SPEEDSTER.

Fred Miller, Director of Department of Automobile Mechanics, Sioux City, Ia.

The automobile mechanics department of the Central High School at Sioux City, Iowa, recently completed a sport model speedster that is attracting a great deal of attention in Sioux City.

Parts from seventeen different makes of cars were used in its construction including a Chevrolet motor, Ford rear axle which has 3 to 1 gears and a Grant-Six radiator. The frame is a Chevrolet cut to a 91-inch wheel-base using a Ford rear spring and Chevrolet front springs and is equipped with Dayton wire wheels which use 30 x 3½ tire. The motor is balanced and fitted with an Oldsmobile head with extra large valves and three exhaust ports. It is also equipped with a coil which has two primary windings which is capable of producing a spark an inch and a quarter long and a special Stromberg racing carburator with an inch and a quarter diameter. On the right side is mounted a two-gallon auxiliary oil tank which is connected with a brass pump for use when driving fast.

On the instrument board fifteen different switches or devices are mounted, including a clock, Saf-T-Stat, cigar lighter, oil pressure gauge, and an ammeter.

In spite of the fact that the car is fitted with fenders, windshield, and a top it is capable of a speed of 87 miles an hour and has exceptional power on hills.

The body is pearl gray enamel with the fenders two shades darker. The running gear and trimmings are red which adds the final touch to a dashing appearance.

The achievement is still more remarkable when it is considered that the entire job was done by high school students. The only jobs that were done by other than students are the top, welding, and enameling.

A DRAWING PAPER HOLDER

Charles W. Frost

This device solves the problem of keeping rolls of drawing, tracing, or blue print paper clean and out of the way—yet instantly accessible.

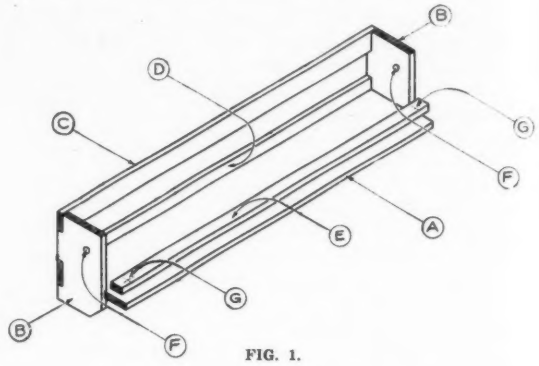


FIG. 1.

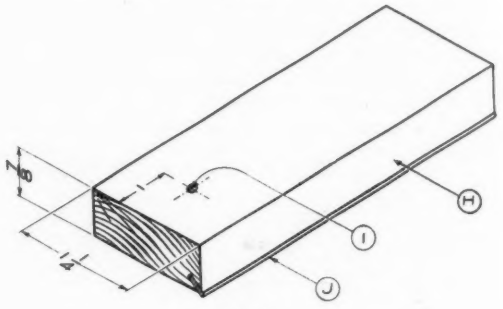


FIG. 2.

Explanation of Drawings

Figure 1.
A—shelf
B—ends of holder
C—top back board
D—bottom back board
E—steel lined straight edge
F—holes through which paper roll pole fits
G—screws holding straight edge to shelf

Figure 2.
H—straight edge
I—hole for screw which holds straight edge to shelf
J—$\frac{1}{16}$"x$\frac{3}{8}$" steel edge.

THE SPEEDSTER AND THE AUTOMOBILE CLASS, SIOUX CITY, IOWA.
FRED MILLER, INSTRUCTOR.

It consists of a shelf, "A"; two vertical end pieces, "B"; two horizontal back pieces, "C" and "D"; a steel lined straight edge, "E"; and a pole from end to end through the holes "F" and "F". The pole is not shown.

The paper roll is placed upon the hole in such a manner that when unrolled it comes off *underneath* the roll, and is drawn out under the straight edge, "E". "E" is loosely fastened to the shelf, "A" by means of twelve gage, two and one-half inch round headed screws at "G" and "G".

When the desired amount of paper has been pulled out, the straight edge is held firmly down upon it while it is severed by running a sharp knife along the steel edge, "J".

A hinged, lightproof, cover converts this into an excellent blue print paper holder and cutter.

A JOB SHEET IN PRACTICAL WOODWORK

Arthur G. Brown and F. E. Tustison

JOB SPECIFICATIONS: To make a utility bench.

REASON FOR JOB: A bench of this type can be used to advantage in many ways. If any sawing is done around the home or shop, a saw-horse is very desirable. The following project will serve as a saw-horse. The opening in the top is especially convenient for ripping. It will also serve as a wash-bench or furnish a handy seat on the lawn.

FIG. 1. BENCH USED AS A SEAT.

FIG. 2. BENCH USED FOR RIPPING.

The making of such a bench involves the use of the sliding T-bevel. The sliding T-bevel is similar to a try-square, excepting that the blade can be adjusted to any angle. To duplicate angles, fit the handle and the blade tightly over a bevel, and tighten the set screw. If the angle is secured by measurement, use the framing square as in Fig. No. 4. Equal marks on the square will give an angle of 45 degrees, or the angle of a miter joint.

MATERIAL: Soft wood stock 1¾" x 1¾" (2" x 4" ripped), 1" x 5" (S 2 S), 8 d. box and 8 d. casing nails.

TOOLS: Pencil, rule, rip-saw, cross-cut saw, plane, framing square, sliding T-bevel, hammer, and nail set.

PROCEDURE: (1) Get out stock for the legs. See Fig. 3.

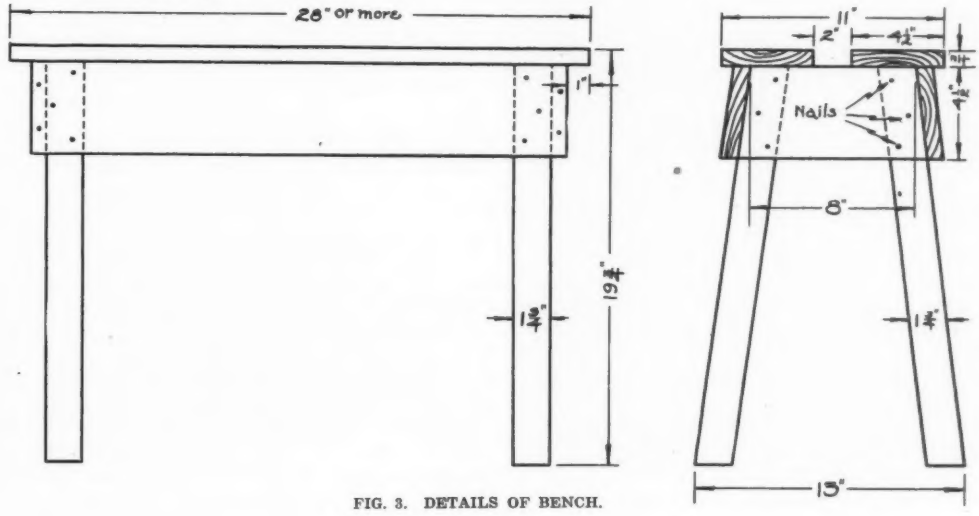


FIG. 3. DETAILS OF BENCH.

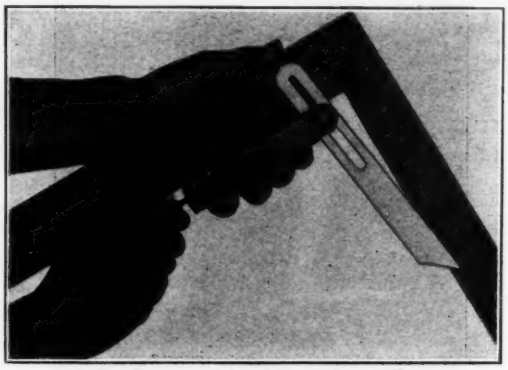


FIG. 4. SETTING THE T-BEVEL BY MEASUREMENT.

If 1¾″ x 1¾″ stock is not furnished, rip from a common 2″ x 4″. Select a length that will make the four legs. Rip and plane to dimensions. Note the bench used for ripping in Fig. 1. Try to keep the dimensions to 1¾″ x 1¾″ but slightly smaller will do.

(2) Get out stock for the rails. If a longer bench is desired it must be provided for at this time. Join pieces to finished width for the rails. Try to keep as close to 4½″ as possible. Note the thickness of 1″ lumber which has been surfaced on two sides (S 2 S). The minimum measurement is 25/32″ or about ¾″.

(3) Set the sliding T-bevel. Note that the legs of the bench stand at an angle. This is to make the bench more stable. For every 4″ of leg length they should spread out ½″. Set the sliding T-bevel as per Fig. 4 to get this angle. You will use the same setting on all legs, ends, and for beveling the top edge of the side rails.

(4) Cut legs to length. Use the bevel for laying out both ends of one leg. The bevel on both ends should be in the same direction. Use this leg as a pattern for the other three. See Fig. 5.

FIG. 5. USING A LEG AS A PATTERN.

(5) Cut ends and sides to length. Use the T-bevel for the end rails but note the side rails have square ends. The tops of the side rails, however, are beveled to the same angle as the legs and ends. Bevel this top edge with the plane. Use T-bevel as you would a try-square to check the bevel of the edge.

(6) Make top pieces. Square up and cut to length, according to the dimensions given. Make the length to suit.

(7) Nail the ends. Use 8 d. box nails and do not nail very close to the end of the end pieces. This is to avoid splitting. Three nails in each leg are sufficient.

(8) Nail on the side rails. Be sure the bevel of the rail is up. Use 8 d. box nails and stagger as per Fig. 3. Staggering is done to brace the legs, and it also tends to avoid splitting.

(9) Nail on the top. Check to get a uniform extension all around the top. Nail on with 8 d. casing nails and set with a nail set.

(10) Paint the bench with outside paint.

QUESTIONS: (1) What are the uses of the bench?

(2) Of what use is the opening in the top?

(3) What is the advantage of slanting the legs?

(4) When is a sliding T-bevel used?

(5) How would you set the T-bevel to get 45 degrees?

(6) What is the meaning of (S 2 S)?

(7) What is the minimum finished thickness of 1″ yard lumber (S 2 S)?

REFERENCES: Noyes, "Design and Construction in Wood," p. 52.

Wood & Smith, "Prevocational and Industrial Arts," p. 19.

MAKING A BILL OF MATERIAL

Oliver W. Barrick, Lock Haven, Pa.

Making a bill of material is usually difficult for a student to learn. Perhaps the reason for this is that the average instructor chooses too complicated an article as an illustration. The boy hears the explanation, and realizes the truth of the various steps, yet he does not understand the method of doing it for himself.

This difficulty may easily be eliminated by teaching the student the steps of making a bill of material for a small simple project, then another more difficult, and so on until he has developed the ability to work out correctly the list material for a good sized job.

Let us endeavor to teach a student in this manner. A complete sketch or drawing should be worked out on paper or put on the board, with dimensions. Take an old standby like a taboret (Fig. 1). In this drawing the

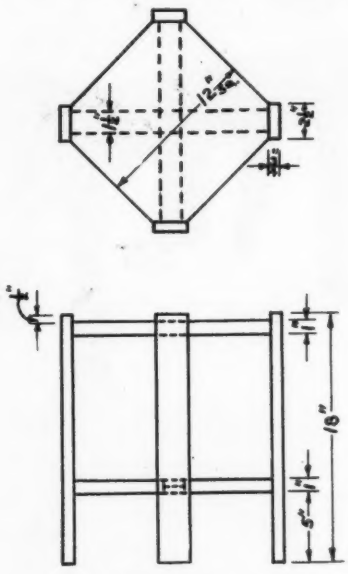


FIGURE 1.

dimensions are given, but the names of the several parts are omitted. The student should be guided to name these parts correctly and should be led to depend a great deal on his own judgment.

The student should be made to see that seven pieces of wood are needed. There are four legs, and these are fully dimensioned. When the student has found the sizes he should record the information on a given form, making note of the kind of wood desired.

The first item to be listed is four legs, measuring ¾″ x 2½″ x 18″. There is one top piece, 1″ x 12″ x 12″. Two pieces are needed for the cross lap brace near the bottom, each is 1″ x 1½″ x 15″. If this taboret is to be screwed together, two screws will be used in each of the top joints, and one screw in each of the brace joints. This

will total twelve screws. The length, size, and kind of screws needed should be listed.

The completed bill of material then will read as in Fig. 2.

The next project to be considered should be slightly more difficult than the first, and should provide new elements to be studied. A pedestal similar to the one in Fig. 3 will serve the purpose. The student should first determine all the pieces which are of the same size and list these under one heading. In the pedestal the first items will perhaps be two tops, 1″ x 12″ x 12″. Next the two brace pieces may be listed, 1″ x 9″ x 9″.

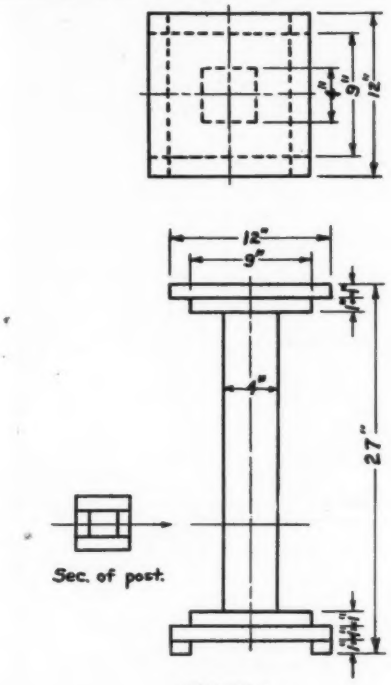


FIGURE 3.

The post will require two pieces, 1″ x 4″ x 22″, and two pieces, 1″ x 2″ x 22″. The pedestal has four blocks to serve as feet, each 1″ x 1½″ x 1½″.

The hollow post must have blocks fitted and glued in each end. Scrap wood may be used so it will not be necessary to record them in the bill of material.

The bill of material will finally be similar to that shown in Fig. 4.

As the student learns the fundamentals and has acquired a little facility, a difficult project like the library table in Fig. 5, may be undertaken. This table involves several thicknesses of lumber, and requires especial care. The larger pieces should be considered first. Thus, the top may be recorded as 1½″ x 24″ x 36″. In some pieces, considerable allowance must be made for cutting the joints. This is true in the case of the rails in this table. Thus, the two wide rails will be recorded as 1″ x 4″ x 30″, and the two end rails as 1″ x 4″ x 18″.

Across the legs near the bottom there are two braces, each 1″ x 3″ x 18″, and across these is a shelf, 1″ x 9″ x 30″. At each end there are panels. The bill should include six panels ½″ x 3½″ x 15″.

Most of the joints should be mortise and tenon, but the top will need to be screwed to the frame. For this purpose there should be included in the bill of material twelve screws, two inch number ten.

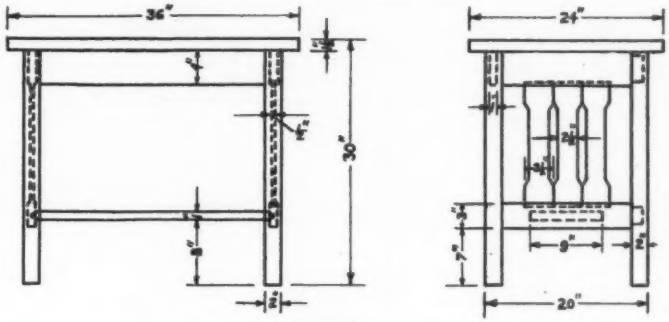


FIGURE 5.

The instructor will find a tendency on the part of many students to be confused and to record wrong sizes in wrong columns. These and other errors can only be overcome by application, practice, and careful checking.

A FRONT DOOR

Victor J. Smith, Alpine, Tex.

The illustrations of the interior and exterior of a front door represent a project somewhat out of the ordinary for the industrial-arts shop. The result, however, was a very satisfactory piece of work which suited the Spanish Mission type of architecture better than doors available in stock designs.

The exterior construction is of B and B flooring, with chamfered edges and end matched to fit grooved head and bottom rails. These pieces were assembled in small sections

OUTSIDE AND INSIDE OF DOOR.

Bill of Material.

Name	No.	Th.	W.	L.	Material.
Legs	4	¾	2½	18	Oak.
Top	1	1	12	12	"
Braces	2	1	1½	15	"
12 – 1½" #10					Screws.

Bill of Material.

Name	No.	Th.	W.	L.	Material.
Tops	2	1	12	12	Oak.
Braces	2	1	5	9	"
Post	2	1	4	22	"
Post	2	1	2	22	"
Feet	4	1	1½	1½	"
20 – 1½" #10					Screws.

Bill of Material.

Name	No.	Th.	W.	L.	Material.
Top	1	1½	24	36	Oak.
Legs	4	2	2	28½	"
Rails	2	1	4	30	"
Rails	2	1	4	18	"
Braces	2	1	3	18	"
Shelf	1	¼	9	30	"
Panels	6	½	3½	15	"
12 – 2" #10					Screws.

FIG. 2 (ABOVE). FIG. 4 (BELOW). FIG. 6 (AT RIGHT).

and the whole tied together with screws by means of a concealed horizontal piece over which each strip is halved. The finish is three coats of exterior paint. The interior is of similar construction with narrow oak flooring and oak head and bottom rail, all finished in fumed oak acid stain to match the interior trim of the room.

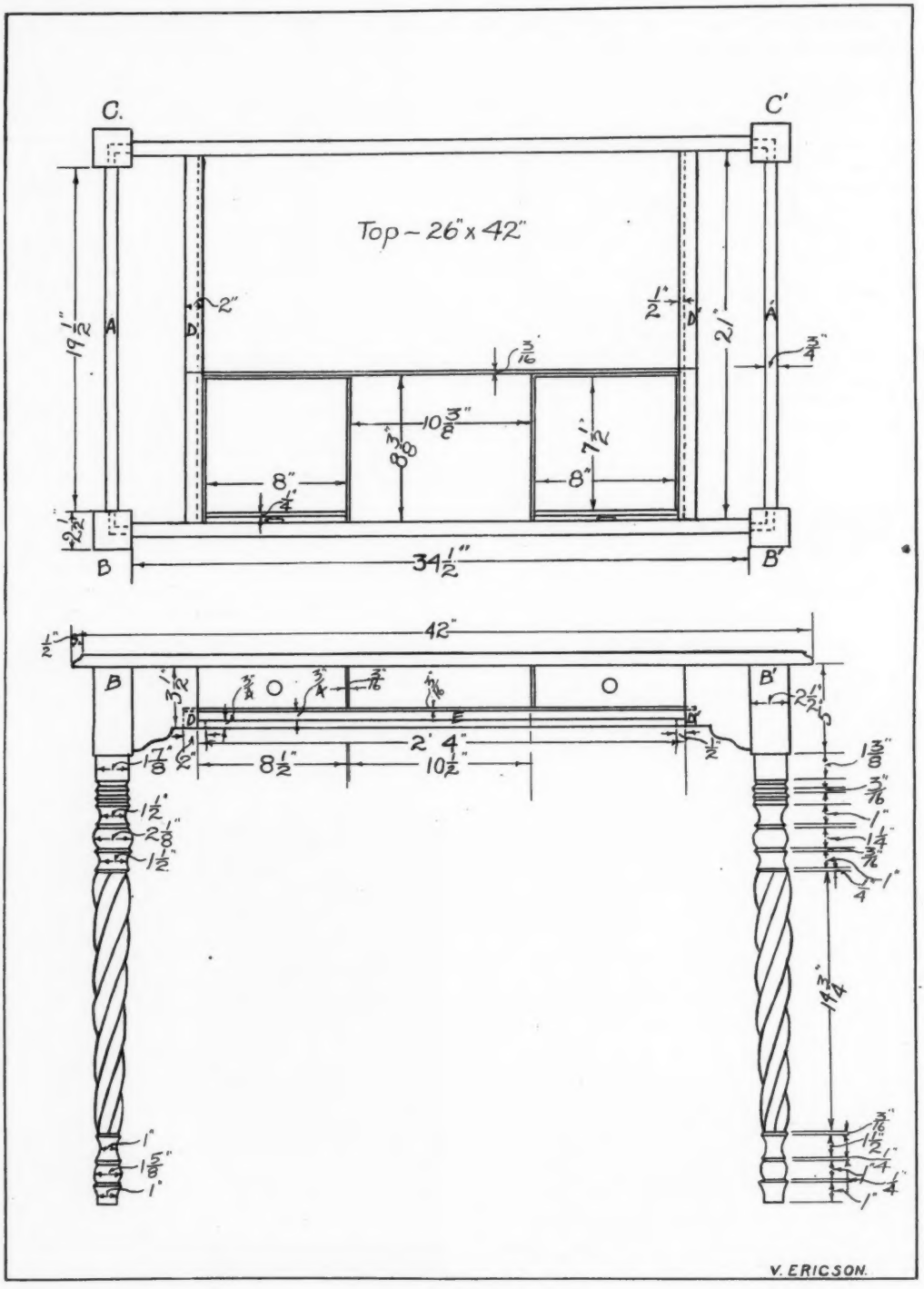
Hardware, consisting of copper handles, knocker, fancy nails (covering screw heads) hinges, bolt, and chest trim add to the effect.

WRITING TABLE

Chas. B. Thomson, Quincy, Mass.

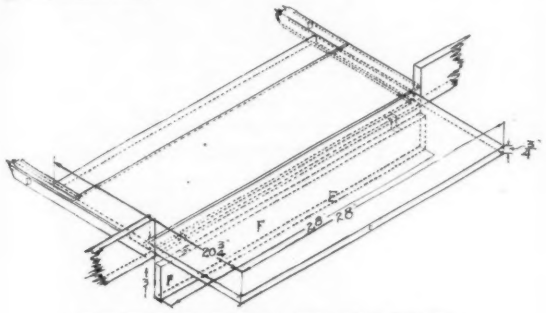
This table was designed for a small living room and made by members of the 1924 manual arts class of the Quincy, Massachusetts, High School.

It has a writing desk attachment which takes the place of the ordinary drawer. What appears to be the drawer front is hinged to the front rail of the table, with invisible hinges and drops down parallel with the front



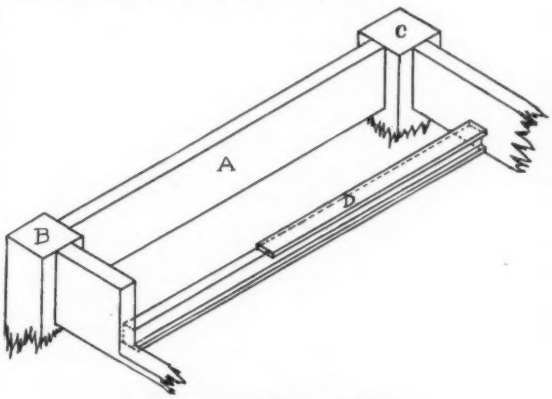
DETAILS OF WRITING DESK.

rail. By pulling forward on what would be the bottom of the drawer, the writing desk is ready for use. Two drawers slide on runners fastened underneath the top. A pen and ink stand, not shown in the drawing, is fastened to the desk leaf.



DETAILS OF DRAWER AND DROP FRONT.

The legs are turned in the lathe, and the spirals, six in number, are laid off and cut by hand. The quarter round on the top is also worked by hand.



DETAILS OF DRAWER RUNNERS.

The table is made of mahogany throughout and is finished in mahogany brown stain and oil finish.

The work on the table was carried on by the class as a group project and the designing and marking of the spirals proved to be a very interesting problem.

Bill of Materials:

For legs, 5 pieces, 2¼″ x 2¼″ x 30″.
For rails, 2 pieces, ⅞″ x 6″ x 33″.
For rails, 2 pieces, ⅞″ x 6″ x 23″.
For writing table, ⅞″ x 20″ x 27″.
For table top, ⅞″ x 26″ x 43″.
One pair of invisible hinges.
Four brass drawer knobs.

A BATTERY CHARGING OUTFIT

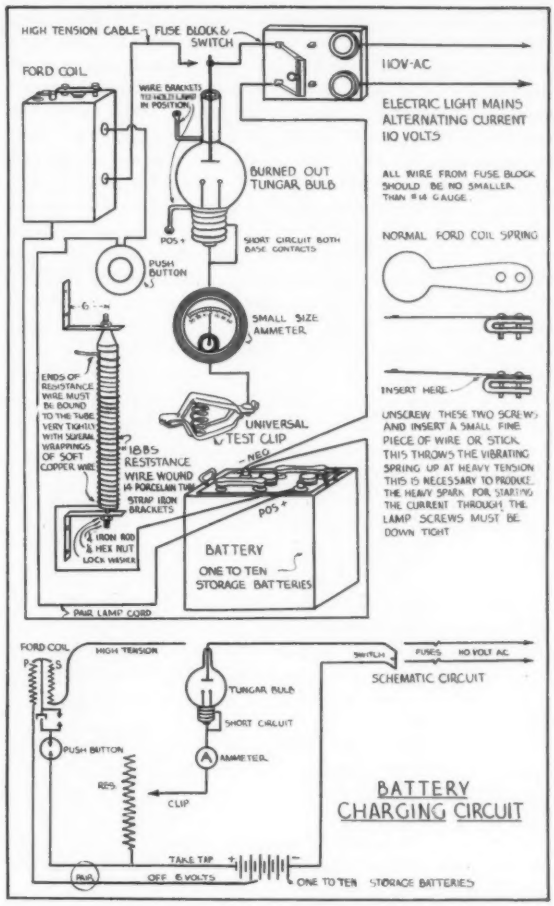
R. N. Perry, San Antonio, Texas

The accompanying diagram represents a battery charging outfit developed in the San Antonio Junior High School, as a successful project in electrical work. It is ample to charge automobile batteries from sizes one to ten.

Material needed:

1 14″x20″x1″ Board. Cover board with asbestos.
1 Fuse block and switch.
1 Push button.
1 Small ammeter.
1 Universal battery clip.
1 Burned out Tungar Globe.
2 1″x6″ L shaped irons.
2 ¼″ Hexagon nuts.
2 ¼″ Lock washers.
2 ¼″ Plain washers.
2 ¾″ Plain washers.
1 16″ Piece ¼″ soft iron rod.
1 14″ Porcelain tube.
1 18″ Piece high tension spark plug cable.
16 Ft. No. 18 Nichome or Advance resistance wire.
4 Ft. Lamp cord.
1 Ford Coil.
Miscellaneous screws.

Assemble the article listed, and wire as instructed in the drawing. Obtain a burned out Tungar bulb of the five-ampere type. It must have at least one post at its original height, and gas in the globe.


HIGH TENSION CABLE
FUSE BLOCK & SWITCH
FORD COIL
WIRE BRACKETS TO HOLD LAMP IN POSITION
110V-AC
ELECTRIC LIGHT MAINS ALTERNATING CURRENT 110 VOLTS
BURNED OUT TUNGAR BULB
ALL WIRE FROM FUSE BLOCK SHOULD BE NO SMALLER THAN #14 GAUGE.
POS +
SHORT CIRCUIT BOTH BASE CONTACTS
NORMAL FORD COIL SPRING
PUSH BUTTON
SMALL SIZE AMMETER
INSERT HERE
ENDS OF RESISTANCE WIRE MUST BE BOUND TO THE TUBE VERY TIGHTLY WITH SEVERAL WRAPPINGS OF SOFT COPPER WIRE
UNIVERSAL TEST CLIP
UNSCREW THESE TWO SCREWS AND INSERT A SMALL FINE PIECE OF WIRE OR STICK. THIS THROWS THE VIBRATING SPRING UP AT HEAVY TENSION THIS IS NECESSARY TO PRODUCE THE HEAVY SPARK FOR STARTING THE CURRENT THROUGH THE LAMP SCREWS MUST BE DOWN TIGHT
185 RESISTANCE WIRE WOUND ON PORCELAIN TUBE
NEG
STRAP IRON BRACKETS
POS +
¼ IRON ROD & HEX NUT LOCK WASHER
BATTERY ONE TO TEN STORAGE BATTERIES
PAIR LAMP CORD
FORD COIL
HIGH TENSION
SWITCH
FUSES
110 VOLT AC
SCHEMATIC CIRCUIT
TUNGAR BULB
SHORT CIRCUIT
PUSH BUTTON
AMMETER
RES.
CLIP
BATTERY CHARGING CIRCUIT
TAKE TAP
PAIR
OFF 6 VOLTS
ONE TO TEN STORAGE BATTERIES

DETAILS OF BATTERY CHARGING CIRCUIT.

Mount the globe with heavy copper wire brackets, about the neck of the globe. Short circuit both base contacts. Mount the fuse block and switch and run one wire directly through the battery line and connect it through the negative post. Run the other wire directly through the top wire terminal of the Tungar globe, and wrap this wire securely on the post with a piece of small size bare copper wire.

Run a Number 14 covered copper wire from the base contacts on the Tungar globe to a small ammeter. From the other side of the ammeter, attach a wire to a universal battery clip. Next wrap the resistance wire on the porcelain fuse and see that the turns of the wire do not touch. Bind the ends securely with a number of wrappings of soft annealed copper wire. Run a wire from the lower end of the resistance wire to the positive side of the battery line. Mount the two on two brackets by means of a wire rod and fasten with hexagon nuts.

Take a good Ford coil and loosen the two screws which hold down the long steel contact vibrating spring. Insert a piece of fine wire under the forward end and then tighten down the two screws. This produces a heavy tension upon the spring and results in a terrific spark. Mount this coil so that the high tension wire can be brought conveniently over the top of the globe.

Turn on the electric light current, 110 Volt A. C., connecting one end to the top of the globe and the other end to the negative side of the battery.

Connect the battery clip about one-third of the way from the bottom of the resistance wire tube. Then with

the right hand hold the heavy high tension wire, that has been skinned a half-inch, about a half to three-quarters of an inch from the top of the globe; then, with the left hand press the push button. The hot high tension current will jump the gap between the end of the wire and between the anode and cathode in the globe. Here is the secret of successful operation: Hold the high tension wire away *as far as possible* from the top post of the globe, and still leave current flowing—this will heat the two upright anodes in the globe and after ten seconds to a half minute the orange color glow will begin on the two lower anodes, and the A. C. current will immediately follow across to the upper cathode, causing a dull red arc which will pass sixty volts at a pressure of twenty amperes, direct current. This rate will be regulated by raising the battery clip on the resistance tube. Don't break the circuit when raising the clip—slide it along the tube.

The Ford Coil can be permanently wired to a separate battery, but really works better on *one battery on the line.*

If for any reason resistance wire cannot be obtained, German silver wire may be used. If no resistance wire is possible to obtain, buy a six pound electric flat iron heating element and use the wire wrapped upon the mica.

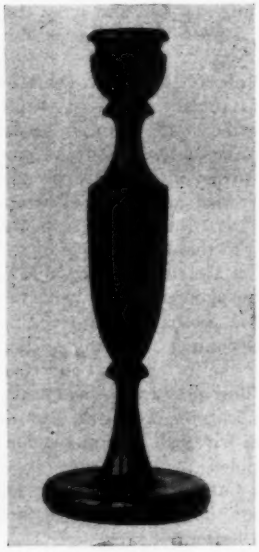
AN ARTISTIC CANDLESTICK

J. R. Vertrees, Peoria, Ill.

The Greeks recognized the effect of good proportion in design. They knew its value in making or marring structural unity, and originated what is known as the "Golden Oblong." That means that the short edge of any thing that is rectangular in shape shall be about two-fifths of the longer side, and the point of interest shall be above or below the middle. This applies in relative heights and widths, and is well carried out in the design for this candlestick. There is a unity of lines and spaces with enough variety to hold the interest and to make it attractive. The continuity of the shape is strengthened by the right use of convex and concave curves and surfaces, and withal a harmony of each part.

The time to introduce this candlestick into the course is at the period when the pupil has finished his exercise pieces in wood turning and is looking about for something to make.

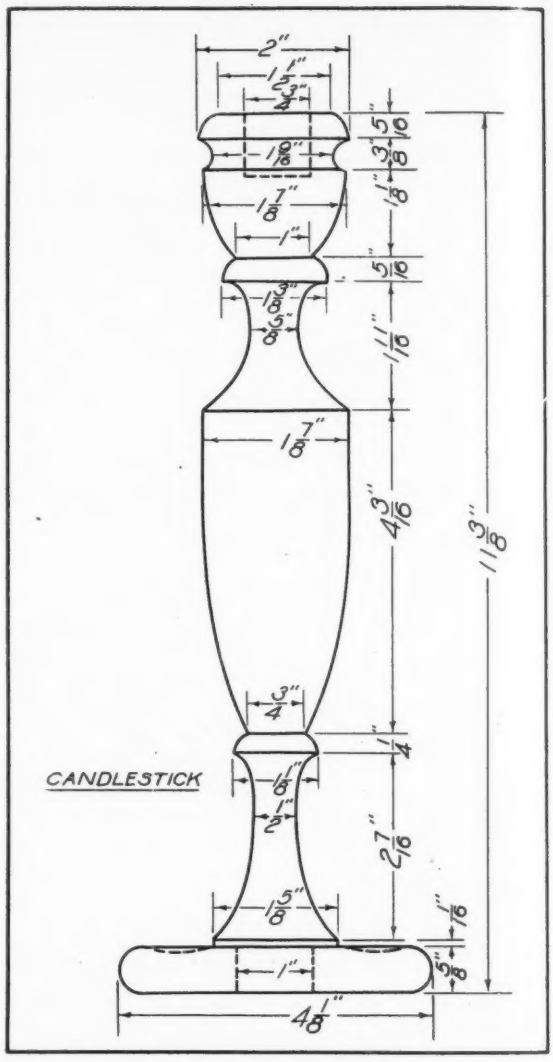
The cuts involved are so varied as to almost completely cover the cuts learned in the exercise pieces. It is also a problem which involves duplicate turning. Any boy who can turn a clean cut pair of these candlesticks will be able to easily turn legs and duplicate spindles for larger pieces of furniture.



CANDLESTICK.

The cost of material is very slight, and the most beautiful candlesticks we have turned were made from discarded, knotty sections of walnut.

A shellac and oil finish may be given while the work is still on the lathe, or as we prefer, a rubbed varnish finish may be put on over a base of shellac. Our method is usually as follows: The wood is carefully sanded and then pumiced, followed by a thin coat of shellac. After drying 24 hours, it is rubbed slightly with steel wool—great care being used not to rub through. A second coat of shellac is given, and is rubbed down more thoroughly. Then a third coat is applied and rubbed down. If by this time all pores are completely filled and a smooth surface is had, then a coat of rubbing varnish is given. After standing 48 hours, this finish is pumiced down with water and a final coat of varnish is applied. This final finish after standing 48 hours, is rubbed down with pumice and oil, followed by rotten stone and oil.



DETAILS OF CANDLESTICK.

If the boy is a careful worker, he has a pair of candlesticks which justify themselves from the point of design and will add beauty to a mantle or spinet desk.

PLUMB BOB

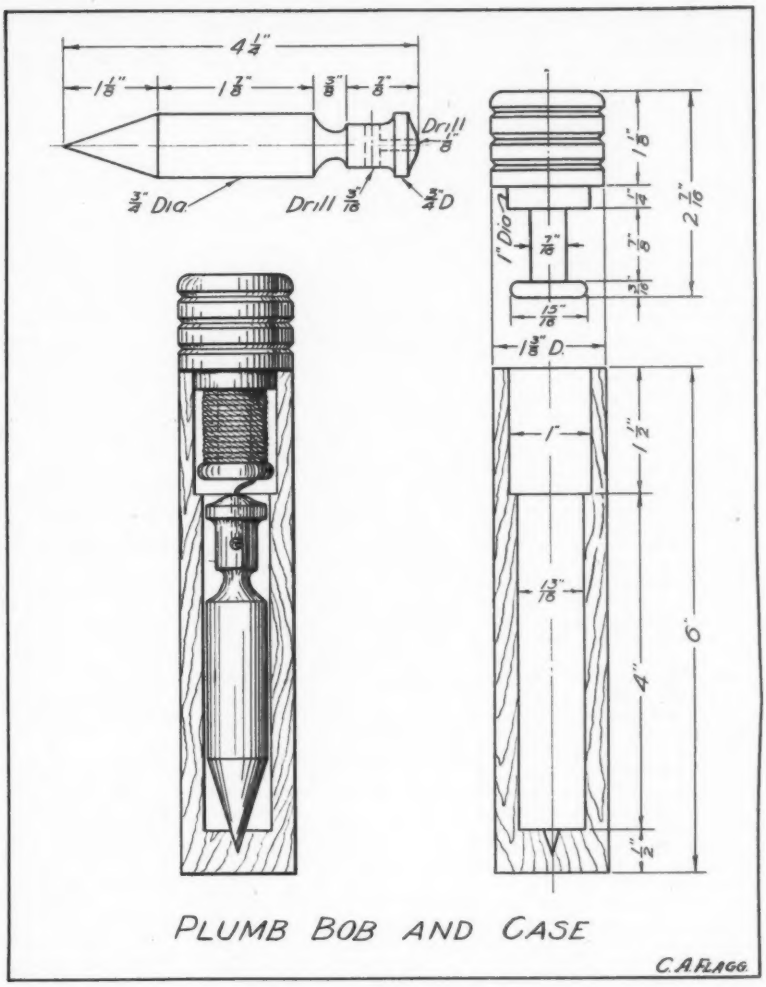
H. J. Wieland, Pattern and Foundry Department, Vocational High School, Virginia, Minnesota

A plumb bob is one of the foremost tools in any erector's, carpenter's, or millright's tool box. It is used for plumbing pipe lines, locating chimney bases and column foundations, and for taking overhead measurements on the floor. Plumb bobs are made of cast iron, cast brass and cast steel, and are solid or hollow. They

are made with automatic reels on the inside, and some of the higher priced ones are loaded with mercury towards the point end. This is to bring the weight as close to the tip as possible. Plumb bobs should be handled carefully so that the point will not be flattened or bent. The plumb bob in the above drawing was turned out of a piece of bar brass held in a 6" jaw universal chuck and turned on a 12"x24" motor head speed lathe. This plumb bob was selected as an advance problem in pattern and model work, and proved very interesting work for the student.

A pattern maker is very often called upon to make the patterns and also finish up the castings on model and experimental work, and in many cases turn up small pulleys and collars to complete the job. A knowledge of metal turning will help him out considerable and make his job a little easier. The above job was selected because it could be turned out in the wood lathe and fitted in fine for a problem in soft metal turning.

The only lathe tool used was a one-fourth round nose chisel. When turning brass, the cutting edge should be just a little below the center so as to give it a scraping cut. If the chisel is held above center or too far out from the T rest, it will chatter and produce a rough surface. This problem consists of a plumb bob, a spool for the line, and a case. The spool top is used for a cover for the case.



DETAILS OF PLUMB-BOB AND CASE.

Directions for Making Plumb Bob

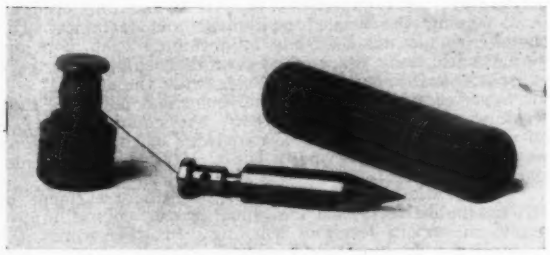
Stock—bar brass ¾" round, 6" long.

(1) Place stock in a good solid chuck. Speed, 600 r. p. m.

(2) Proceed to shape as per drawing. Go about it the same as you would when turning bone or rubber. The chisel should be ground a little blunt so as to retain its edge longer. The chisel should rest just above the T rest shank as this is the most solid place on the rest and will eliminate the chatter.

(3) Turn the bob up to the top ornament.

(4) Smooth off cut with a coarse file and follow with smooth file, using a very fine file on last draw.



PLUMB BOB.

(5) Use No. 1 sandpaper following filing and finish up with a medium grade steel wool without oil.

(6) Saw off surplus stock and rechuck.

(7) Turn head ornament and bore top hole. Finish same as the rest of the job.

(8) Center punch cross hole on two sides.

(9) Place chuck and drill in head stock and drill half from each side. Ream out edge of hole a little so that line will not cut.

Directions for Making Case

Bottom. Stock—2x2x8 walnut.

(1) Reduce stock to cylinder and prepare one end to fit into bell chuck of desired size. Allow 1½" for chuck stock.

(2) Bore 1⅛" hole 4½" deep.

(3) Bore 1" hole and shoulder to 1½" deep.

(Use Forstner bit in three jaw Jacobs chuck held in tail stock. Speed about 2,000 r. p. m. This speed will produce a finished hole.)

(4) Turn outside to diameter and sandpaper. Apply a coat of white lead. Prepare a polishing pad dipped in white shellac, and polish to desired gloss. Polish at about 1,000 r. p. m.

Top. Stock—2x2x4½ walnut.

(1) Chuck stock as in bottom turning.

(2) Turn end to 1" diameter and make snug fit into bottom.

(3) Shape spool, and turn outside diameter to match bottom.

(4) Finish up same as bottom.

(The V cuts in the top are not for ornamental purposes, but to help give a better grip.)

The spool as drawn will take 25 yards of silk fish line.

DEPARTMENT OF VOCATIONAL EDUCATION—N. E. A. AT INDIANAPOLIS

S. Lewis Land

The Department of Vocational Education, an allied organization of the National Education Association, held two interesting sessions during the Indianapolis meeting, June 29 and 30. In the absence of the President, John N. Greer, Minneapolis, Harry E. Wood, director of vocational education and manual arts, Indianapolis, presided. The theme of Monday's meeting in the auditorium of Emmerich Manual Training High School, was "Part-Time Continuation and Cooperative Schools and What is Being Accomplished by Them in the Conservation of Youth."

"The crowning sin of most of us is that we are too 'teacherish,'" declared Omar H. Day, associate professor of vocational education at Purdue University, Lafayette, Indiana, in opening the discussion on part-time education. Mr. Day described the aims of the continuation school and named the qualities that a good continuation school teacher should possess. "We continuation school teachers," he continued, "know too little about things outside our classrooms, and we do not care to know more. We need to have some manual training injected into our teacher training courses. The continuation school teacher should get a large part of his training, working at jobs, not in positions. I should like to see written into every continuation school teacher's contract, no matter what his grade, subject, standing, or term of service, a clause that would require him periodically to leave the classroom and earn his living outside. He thus would get understanding and sympathy with the continuation school child."

Teachers in the part-time schools, Mr. Day said, must be masters of their trade, must be persons whose skill is not questioned, and must be able to make a living by their trade outside teaching.

Mr. Day was followed by Mr. A. B. Mays, Associate Professor of Industrial Education, University of Illinois. "Part-time education expresses the claim of the school on the boys and girls who are out of school trying to adjust themselves to the economic and social life of our great industrial nation," Mr. Mays declared. "It is an effective step in the direction of universal education, and toward equal as opposed to identical opportunities for all children.

"If our schools are to express the American ideals of democracy they cannot continue to neglect our employed children. Notwithstanding the fact that the principle of democracy has been the dominant factor in the creation and support of the public system of education, the practices of our schools have fallen far short of democracy. Too great an effort has been made to force all children through the same experiences under identical conditions and by identical methods. Many boys and girls can be more effectively educated under a system of part-time work and part-time school.

"Large groups of children do not seem able to make progress beyond a certain point in their school careers. Many such boys and girls later in life, astonish their teachers and critics by achieving success in their chosen fields of work. For such young people, the vigorous, competitive life of the commercial and industrial world is necessary for their best development. The regular type of school may be even a positive hindrance to growth.

"The oft-repeated plaint of men who early left school to work that, 'I wish I had more education,' suggests, however, that the school after all may have much of real value for the boy and girl who do not seem to profit by its experiences. It is one of the functions of the part-time school to reconcile these two conflicting conditions. This is accomplished by sifting out of the great mass of school material, those things which are known to be of real value to the average man, and so organizing and teaching these things as to make them definitely relate to the occupational world in which so many boys and girls are interested.

"There are young people who profit immeasurably by the school training of our wonderful full-time schools, but for those who for any reason do not so profit by the regular type of school the part-time school is performing a most important service."

The theme of Monday's meeting was continued Tuesday afternoon at the second and final session. The principal speaker at this meeting was Mr. H. G. McComb, state supervisor of industrial education for Indiana.

Mr. McComb spoke on the part-time cooperative arrangement which is being carried out between the schools and industries of Anderson, Indiana. For the past two years there has been in operation in Anderson, a cooperative scheme of education similar to that worked out in a few other centers. The plan at Anderson, as far as it has been developed, includes 28 boys—fourteen in school and fourteen in industry. These two groups of boys alternate weeks in school and in industry. The plant has set aside a shop for the school work, and has employed a man to supervise the work done in this shop. After a period of one year the industry says it is a paying proposition. At the beginning of the period, the boys are furnished with a set of tools, worth $50. The money for the tools is taken out of the boys' weekly pay—$1 a week until the tools are paid for. If the boy remains with the plant for a period of two years, the $50 paid for the tools is refunded, and he is given the tools.

Mr. McComb pointed out the following advantages to the boy and to the employer:

Advantages to the boy: 1. Gives some boys, who would not otherwise be able to go to school because of economic reasons, a chance to earn while they learn.

2. Gives opportunity for practical application of school work to employment.

3. Gives opportunity for students to get a background in industry, of science, economics, and citizenship.

4. The try-out values involved, give opportunity for failure to offer opportunity for readjustment and ultimate success.

5. Gives an educational background for an engineering course.

Advantages to employer: 1. Makes possible more scientific methods of employment.

2. Gives industry a chance to develop a spirit of loyalty.

3. Production is cheaper.

Mr. McComb concluded by making the following statements as to the results of the experiment: 1. Industry is looking to the school for further training, in the form of (a) trade extension training, and (b) foreman training.

2. A most cordial relationship has been developed between school and industry.

3. Other employers of Anderson are going to the school authorities, asking for assistance from the school.

At the business session following Mr. McComb's address, the following officers were elected for the year: President, O. H. Day, associate professor of industrial education, Purdue University; Vice-President, Howard L. Briggs, director of vocational education, Cleveland, Ohio; Secretary, H. G. McComb, state supervisor of industrial education, Indianapolis, Indiana.

NATIONAL VOCATIONAL GUIDANCE ASSOCIATION CONVENTION, INDIANAPOLIS, JUNE 29

The National Vocational Guidance Association met in the auditorium of the Y. M. C. A., Indianapolis, on Monday, June 29. The meeting was presided over by Milo H. Stewart, principal of the Arsenal Technical high school, Indianapolis. The first topic presented was "New Light on Vocational Counselling," by S. Lewis Land of the University of Wisconsin. Mention was made of the kinds of counselling activities which should be carried on in various types of schools, and of the qualifications and training necessary to successful counselling. Some of the more important findings of the recent investigations of Dr. Edgerton were presented. The work of the counsellor was outlined in detail and a number of aids to counselling were suggested.

"Since the work of counselling is of such growing importance, it is imperative that it be administered by those having the needed equipment and training. The mistake should not be made of assuming that men and women with many years of successful teaching experience make successful counsellors. Such is not the case. Teaching experience is an asset to the counsellor, but more than teaching experience is required. The counsellor should have a broad, comprehensive knowledge of the work-a-day world. Contacts with many types of life work are desirable.

"The task also demands the scientific treatment of all obtainable facts bearing upon proper counselling of pupils on various levels of learning. In other words, the counsellor must have the scientific attitude. Guidance is scientific. Progress in counselling will be made only through a careful and scientific study of its problems.

Mere opinion must give way to facts secured through trustworthy investigation. Experimentally determined evidence must take the place of opinion.

"One of the things for which we have been criticized in the past has been that counselling has been too subjective. Counsellors must replace subjective work with work on a more objective basis. This can be done only through a scientific approach to counselling problems.

"The application of intelligence tests, achievement tests, and aptitude tests, in vocational guidance, is in the experimental stage, but enough progress has been made to justify their use in a limited way. There are so many abilities, capacities, and traits that make for success in the various life callings, that the basis of classification must be of a flexible nature. If the counsellor realizes the limitations of tests as measures of ability and as factors in guidance, they may be used to very great advantage as aids in vocational guidance.

"It is recognized that intelligence tests alone cannot be used for the purpose of predicting success. Many factors other than intelligence, enter in to determine success. It is necessary to determine what these other factors are, and after they have been determined, to supplement intelligence tests, by other tests for the testing and measuring of factors other than intelligence in the human personality."

Mention was made of the accomplishments of those who are working in the field of prediction. Reference was made to the work of Dr. Hull at the University of Wisconsin, and of Dr. Thurstone at Chicago University.

"Those who are working in the field of prediction, clearly recognize its present limitations, but are encouraged by its future possibilities.

"The ideal toward which every effort should be directed is the most sympathetic understanding of the desires, needs and capabilities of all children of school age, whether in or out of school, for the purpose of making intelligent adjustment of all school work or of employment, in accordance with present and future possibilities of accomplishment."

The second speaker was M. Edith Campbell, Director of Vocation Bureau, Public Schools, Cincinnati, Ohio, who spoke on "The Organization of a School System for Vocational Guidance." Miss Campbell spoke of the work in Cincinnati, gave some valuable suggestions concerning the organization and administration of guidance, and pointed out some of the difficulties a guidance worker encounters.

She pointed out that the guidance organization should be a part of the public school, since the school is the most powerful and strategic factor in the community, and since the school has the access to the home which no other organization can have. She said that the fact that guidance was being discussed in an administrative way is an indication that it has gotten beyond the experimental stage and is here to stay. She spoke of the difficulty of getting recognition for courses of university grade for the training of guidance workers, and pointed out the difficulty of securing the cooperation of regular teachers in a school system in the administration of the guidance functions.

"There is no more complicated, puzzling organization to administer," she said, "than the guidance organization, and it is constantly becoming more intricate and complicated."

Following Miss Campbell, Miss Olga Schellschmidt of Indianapolis read a paper on "Gathering and Dissemination of Vocational Information," prepared by Miss Florence Clark, of the vocational guidance bureau, Chicago. In her paper Miss Clark presented various ways and means of gathering and disseminating vocational information, told of methods used in various school systems, and gave in detail the methods used in Chicago. She deplored the fact that schools have been making more provisions for disseminating than for gathering vocational information. She said "the vocational information service must be a service which will furnish accurate, scientific, vocational information."

Following the reading of Miss Clark's paper, Miss Emma Prichard Cooley, director of vocational guidance, New Orleans, La., spoke on "Granting of Scholarships as a Phase of Vocational Guidance." The scholarship movement has been a sociological one rather than psychological or pedagogical, according to Miss Cooley.

"Grants of scholarship, as a phase of vocational guidance, have entered upon the most difficult period of their development," said Miss Cooley.

In addition, she said, "It is no longer necessary to demonstrate the fairness of the plan, since a widespread interest had developed in the importance of conserving to the schools and ultimately to society, that small percentage of educational waste directly attributable to economic pressure. In many communities, business men are leading the way in securing the finances for carrying on the work.

"The second stage must deal with methods of coordinating scholarship work with other factors of the guidance program, of establishing standards of directing policies. In New Orleans, scholarship work is so important a factor in vocational guidance that in the minds of many laymen, there is no distinction between the department and one of its activities. The following methods have been employed in coordinating the program:

"1. Award of scholarship on basis of economic need and mental liability, as a result, of a summary of school records, reports of home visitor, mental tests and physical examinations.

"2. Recommendation by counsellor, after summary of conditions indicated above, as to type of school or course of study to be elected by beneficiary with view to later vocational choice.

"3. Supervision of scholarship cases by counsellor. Emphasis placed upon educational progress. Continuance of scholarship aid contingent upon such progress.

"4. Placement, on graduation, by Department of Vocational Guidance in positions affording promotional opportunities. Or, where conditions warrant, scholarships at college or assistance for further training secured through cooperation of interested organizations and individuals."

Outstanding subjects for discussion which were pointed out by Miss Cooley were as follows: 1. Should scholarship aid be in the nature of a loan or a direct gift? 2. Should assistance be limited to the superior type of child? 3. If so, is this not contrary to the fundamental principle of guidance, which seeks to make education democratic in fact as well as in theory?

At the business session following the program the following officers were elected: President, Milo H. Stewart, principal of the Arsenal technical high school, Indianapolis; Vice-President, Harry D. Kitson, professor of psychology, Indiana University; Secretary, M. Edith Campbell, director of vocation bureau, Cincinnati, Ohio.

Industrial Arts Vocabulary

F. S. Crispin, Philadelphia, Pa.

(Continued from August.)

Casing—(arch.)—The framework about a window or door.

Casement Window—(arch.)—A window hinged on its vertical edge to permit opening inward or outward.

Castings—Metal parts made by pouring the metal when liquid into molds of sand, metal, or plaster of paris.

Caulking—Making a joint or seam water tight or steam tight by filling it in with rust cement; oakum is frequently used on wooden vessels.

Caulking Tool—A blunt-ended piece of steel formed somewhat like a chisel, used for closing up the joints of boiler plates. It is driven against them by sharp blows from a hammer.

Catch Basin—A masonry pit used in connection with and usually directly under the inlet through which storm water flows to reach the sewer.

Cavetto—(arch.)—A quarter round concave molding.

Celluloid—A composition of camphor and gun-cotton.

Center—or centre—A fixed point about which the radius of a circle or an arc of a circle moves.

Center of Gravity—That point in a body about which it will be balanced when placed in any position.

Center Punch—A steel punch about three or four inches long, having one end ground to a conical point, used in laying out work.

Center Square—A tool used for finding the center of a circle or of an arc of a circle. Its most frequent use is in locating the center point on the end of a shaft or cylinder to be turned.

Chamfer—A bevel given to edges otherwise sharp.

Charcoal—Wood which has been charred and carbonized by imperfect combustion in an air-tight chamber.

Chatter—A rattling caused in machine work by lack of rigidity in the cutting tools or in machine parts.

Channel Iron—Long strips of iron having a section like three sides of a hollow square.

Checker Brick—(arch.)—An arrangement of bricks into checker board formation with open spaces for draft or ventilation; bricks generally used are 2″ x 2″ x 8″ in size.

Chemical—Pertaining to chemistry.
Cherry Wood—A hard, close-grained reddish or brownish colored wood.
Chestnut—A medium hard, coarse-grained wood, extensively used for building trim and for inexpensive furniture.
Chill—A metallic mold into which especially mixed molten iron is poured to produce a chilled casting.
Chilling—The hardening of the surface of iron castings by pouring certain mixtures of the metal into cold metallic molds.
Chimney Breast—(arch.)—The offsetting or building out of a wall about a chimney. Its principal purpose is to avoid the unsightly appearance of a narrow chimney projecting from a side wall into a room.
Circle—A ring; a plane figure described by a straight line moving around a fixed point called the center.
Circuit Breaker—(elect.)—A switch, usually automatic, which opens to stop the flow of electric current.
Circular Pitch—(mech.)—In gearing, the distance from the center of one tooth to the center of the next, measured on the pitch line.
Circular Plane—A plane used for smoothing a curved surface.
Circular Saw—A saw whose teeth are spaced around the edge of a circular disc running upon a central arbor.
Circumference—The boundary line of a circle; the length of the line which forms a circle.
Circumscribe—To inclose within certain lines or boundaries. In drawing to draw around or outside of something.
Clamp—A tool used for holding portions of work together, both in wood and metal.

Clamp

Clamping Screw—Any screw by which a piece of work or a tool is pinched or held together. A screw which clamps.
Clapboard—(arch.)—A lapping weather board used for siding.
Classic Molding—(arch.)—Molding similar in section to the moldings used in the classic orders of architecture.
Claw Coupling—(mech.)—A loose coupling used in cases where shafts require instant connection or disconnection. It is somewhat like a flange coupling but has projections or claws cast upon each face, which engage in corresponding recesses in the face opposite.
Clearance—The amount of space, open or free, between adjoining parts.
Clock-wise—In the same direction in which the hands of a clock move; i. e., with the right-hand motion.
Clutch—(mech.)—The device by which a temporary connection is made between separate pieces of shaftings, etc.
Coefficient—A number indicating the degree of quality of a substance or material.
Cofferdam—A wall of piles between or within which excavation is done for foundations.
Coke—Coal from which the volatile constituents have been evaporated either by partial combustion or by distillation.
Cold Chisel—A short chisel tempered to cut cold metal.
Cold Rolling—The rolling of iron cold produces a high tensile strength, but with a sacrifice of ductility and toughness. The surface of iron when cold rolled has a greater smoothness and polish than when rolled hot.
Collar—(mech.)—A ring formed on a shaft by forging in the solid or by being made as a separate casting or forging, bored or turned. Held in place with a set screw or a split pin; may be shrunk on or allowed to run free.
Collar Beam—(arch.)—A horizontal beam connecting the sloping rafters of a roof. It occupies the same relation to the roof rafters as that existing between the cross bar and the sides of the letter A.
Collet—A drill socket. (2) A taper shanked arbor with the larger end threaded and split so that tools may be clamped in it.
Column—(arch.)—A column may be considered as a beam set on end, and receiving pressure in the direction of its longitudinal axis.
Combination Chuck—A universal chuck which may also have action independent of the jaws.
Common Brick—(arch.)—Brick such as is used on rough work or for filling in or backing.
Compass—(drawing)—An instrument consisting of two (sometimes more) legs, usually pointed, and joined at the top; used for taking or marking measurements, subdividing distances, describing circles or curves, etc.

(To Be Contiued)

NEW BOOKS.

Generators and Motors

By David P. Moreton, A. C. Roe, and Carl H. Dunlap. Cloth, 216 pages, illustrated. The American Technical Society, Chicago.

This "home study" book is divided as follows:
D. C. armature winding—81 pages.
D. C. motor and generator repair—34 pages.
A. C. motor and generator winding—36 pages.
A. C. motor and generator repair—30 pages.
Induction motor wiring diagrams—27 pages.

All the D. C. work is reprinted from other books by the same publishers. The A. C. work is, however, new.

Each subject has been presented in such a manner that a man who is getting his education through home study can actually master an understanding of the work as technical terms have been avoided and the language is simple.

No text can take the place of an instructor, but this book will be found of great value to the repair man in the school, shop or industry.

Dynamos and Controllers

By C. C. Adams, F. B. Crocker, and George J. Kirkgasser. Cloth, 272 pages. The American Technical Society, Chicago.

The book is divided into two main divisions: "Industrial Controllers and Management of Dynamo"—"Electric Machinery".

The section on "Controllers", (100 pages), is well written and covers both D. C. and A. C. starters and speed regulators. In the light of industrial demand, more space probably should have been given to polyphase compensators.

"Management of Dynamo—Electric Machinery" covers 120 pages. This section is largely a reprint from "Direct Current Machinery" although the condensed chapter of "Locating Motor and Generative Troubles" is not. This chapter should be very helpful to the "trouble man".

Diagrams and photographic reproductions occupy about fifty per cent of the book. The text is not too technical to be easily understood although these are probably not sufficient "reasons" given to satisfy the workman or "home study" student who is ambitious to know the "whys and wherefores" of his work.

Elements of Retailing

By Ruth Leigh. Cloth, 385 pages, illustrated. Published by D. Appleton & Co., New York.

While this textbook modestly proclaims itself "a simple outline of the elements and principles of modern store keeping" it is in reality a very thorough treatment of the organization, management, and operation of a dry goods and general merchandise store. Its appeal is directly to the young clerk of continuation school or night school grade, but we dare say most retail merchants—even college graduates—would derive immense benefits from a study of it.

Margins and Imposition, Regulation Sizes and Paper Trade Customs. By Henry A. Breucker, Printing Trade School, Cincinnati, Ohio. While this book is modestly termed a compilation, it contains a great deal of practical information stated in an original way and suited especially for school use. Part I takes up the practical problems of locking up forms from the simplest one-page form to the largest 32-page form. Additional chapters contain complete details concerning the sizes for stage booklets and paper trade customs. The last chapter is made up largely of tabulations of paper sizes and weights and will be found useful because of its splendid arrangement. Every teacher of printing will want a copy of this booklet in his office reference file.

How to Know and Use the Trees. By Wm. C. Coker and Enid Matherly. Vol. III, No. 14, of the Extension Bulletins. University of North Carolina Press, Chapel Hill. This pamphlet takes up a study of the trees of North Carolina, dealing principally with their use for shade and ornament. It offers a number of basic principles for the design and planting of trees and shrubs around schools and public buildings. There is a key to various plantings illustrated in the booklet.

Concrete Tile Resists Intense Heat. By Harley Wadsworth. Reprinted from the Builders' Exchange Bulletin by the Portland Cement Association, Chicago, Ill. A test demonstration showing that concrete building material withstands heat up to 1800 degrees. The test showed that in many cases, fires which often sweep an entire city block, can be stopped by a concrete building. It also emphasized the fact that concrete hollow tile construction provides for building permanently and rigidly, so that the structure is unaffected by time and the elements.

By means of a pyrometer, temperature readings were taken through a pipe extending through the tile wall of the building on the front side to the left of the door of the structure tested. Although a temperature of 1800 degrees Fahrenheit was registered at the maximum point, the outside wall of the building remained cool to the touch, substantiating the claim of concrete products men that hollow concrete masonry serves as insulation against temperature changes. It was brought out that the walls of the structure not only withstood the intense heat applied to them but failed to crack and crumble upon the application of cold water directly to the surface of the material.

Plane and Solid Geometry

By Arthur Schultze, Frank L. Sevenoak, and Elmer Schuyler. Cloth, 480 pages. The Macmillan Co., New York City.

A thorough revision of a book which has been popular since 1901.

A COURSE IN ELEMENTARY CABINET MAKING

Outlined by J. A. Shelly, Vocational Department, Public School, No. 32, Jersey City, N. J.

(Continued from May)

Circular Saw Operating

Ripping: In starting to rip see that the stock is tight against the fence. Start the cut slowly so as not to reduce the speed of the saw; gradually increase the speed of the feed until the saw is cutting as much as it readily can. Keep the body to the left of the line of the saw so that the fence may be seen from end to end. This will give the operator full control of his work and enable him to get out of the way quickly if he sees that anything is going to fly back. In feeding the stock apply the pressure in the center of the part of the piece that is between the saw and the fence, and do not pay too much attention to the waste piece on the outside of the saw; if left alone this piece will take care of itself. The feeding should be done with the right hand. In ripping narrow pieces a push stick should be used. This should be a light piece with a notch cut in the end. As the stock passes beyond the center of the saw a slight clearance will be observed at the back of the saw, allowing freedom of delivery and preventing the stock from binding.

Adjusting the Saw: The saw should be adjusted so that it projects about ⅛" above the stock. This is to prevent binding and overheating the saw.

Binding: If the stock should close in on the back of the saw and bind, or if any other trouble should arise, the operator should hold fast to the stock and shut off the power. If unable to shut off the power alone he should call for help but under no circumstances should he let go of the stock, as it is liable to fly back and injure him. In ripping long pieces the puller through should have a screw driver, or some wedges, to drive in the saw kerf if the stock has a tendency to close in on the saw.

Safeguards: Be sure the saw guard is in place and properly adjusted, also that it is securely clamped. Clear the saw table with a stick, never use the hand for this purpose, drop the saw below the level of the table when finished with it. Keep stock and loose pieces off the saw table and under no circumstances should the operator ever reach over the saw.

Crosscutting: Remove the ripping fence from the saw table and use the sliding carriage or gage when crosscutting stock. It is dangerous to place the end of the stock against the ripping fence to cut pieces to length; a clearance block should be used for this purpose. If the stock is not severed, however, as in making shoulder cuts, it may be safely placed against the fence when used in connection with the sliding carriage.

Serving the Operator: In serving stock to the operator pass it to him in such a way that the face side or edge will come naturally to the fence so that he will not be forced to examine each piece before passing it through the saw. In re-sawing reverse the piece endwise so as to keep the face side against the fence.

CIRCULAR SAW OPERATING
Main Processes and Essential Operations

(1) Ripping Parallel Pieces
- (a) Raise or lower saw to correct height.
- (b) Clamp saw adjusting mechanism.
- (c) Set and clamp ripping fence roughly.
- (d) Make final adjustment with micrometer adjustment.
- (e) Adjust saw guard.
- (f) Start saw.

(2) Squaring Ends and Cutting to Length
- (a) Set crosscutting gauge or sliding carriage square by protractor on end of gauge.
- (b) Adjust saw guard.
- (c) Start saw and make a test cut to determine whether the gauge is square with the saw. Test the cut with a try square.
- (d) Make final adjustment of crosscutting gauge.
- (e) Square ends of all pieces to be milled.
- (f) Put gauge bar in place and set stop to cut pieces to length.
- (g) Cutting to length with clearance block. Place block against fence and set the saw from block to saw instead of from fence to saw.
- (h) Fasten block to fence with thumb screw.

(3) Resawing
- (a) Set saw so that it projects above table slightly higher than half the width of the piece to be resawn.
- (b) Adjust fence and pass stock through saw, reverse stock end for end and make second cut.

(4) Cutting Faces of Tenons from Ends of Stock
- (a) Dress stock to width, thickness and length.
- (b) Adjust saw to project above table the required length of tenon measured from the end of stock.
- (c) Set the fence to cut the face farthest from the face side of stock, measuring from the fence to the inside of saw.
- (d) Make first cut with face side of stock against fence.
- (e) Set the fence to cut the face nearest the face side of stock, measuring from the fence to the outside of saw.
- (f) Make the second cut with the face side of stock against the fence.

(5) Cutting Shoulders
- (a) Adjust saw so that it projects above table the required height for the depth of cut.
- (b) Set fence for length of tenon from end of stock, measuring from fence to outside of saw.
- (c) Make shoulder cuts with edge of stock against sliding carriage and end against the fence.

Second Method
- (a) Cut one end according to the foregoing instructions.
- (b) Place gauge bar in place on sliding carriage and set the stop to give the required distance from shoulder to shoulder.
- (c) Set the shoulder already cut against the stop and make the second shoulder cut.

(6) Rabbeting Lengthwise
- (a) Adjust saw for depth of rabbet from face of stock.
- (b) Set fence for width of rabbet on face of stock, measuring from fence to the outside of saw.
- (c) Make the first cut.
- (d) Set fence the difference between the width of the rabbet on the edge of the stock and the thickness of the stock, measuring from the fence to the inside of the saw.
- (e) Make the second cut with the first saw kerf facing outward from the fence.

(7) Rabbeting Ends
- (a) Adjust saw for depth of rabbet from face of stock.
- (b) Set fence for width of rabbet from end on face of stock, measuring from fence to outside of saw.
- (c) Make cut with edge of stock against sliding carriage and end against fence.
- (d) Set fence the difference between the width of the rabbet on the end of the stock and the thickness of the stock, measuring from the fence to the inside of the saw.
- (e) Make the second cut with the first saw kerf facing outward from the fence.

(8) Stopped Rabbets
- (a) Follow directions for rabbeting in setting saw and fence.
- (b) Clamp stops on saw table to fix starting and stopping points of rabbet, place end of stock against front stop and face or edge against the fence. Lower stock on saw and cut until end strikes second stop.

(9) Dadoing (with Saw)
- (a) Set saw to project above table the depth of required dado, and fence to give the distance from the end to the first cut.
- (b) Reset fence to make second cut which fixes the width of the dado.
- (c) Mill out the stock between the two saw cuts.

(10) Stopped Dadoing

General directions for dadoing and stopped rabbets will apply here.

(11) Grooving (with Saw)
- (a) Set saw to project above table the depth of the required groove.
- (b) Set fence to cut edge of groove nearest face side of stock.
- (c) Reset fence to make second cut farthest from the face side.
- (d) Mill out stock between cuts.

(12) A Butt Joint Box
- (a) Dress stock for the sides and ends to the required width.
- (b) Square the ends of all pieces and cut the sides, top and bottom to length.
- (c) Cut ends to length.
- (d) Rip top and bottom to width. To set the saw for this operation place the two sides against the fence and one of the ends against the sides. This will give the width of the top and bottom without the use of a rule.

(13) A Drawer (Front Rabbet-Dadoed to Sides, Sides and Front Grooved for Bottom)
- (a) Dress stock for front, sides and back to width.
- (b) Square one end of all pieces and cut front sides, back and bottom to length.
- (c) Set the saw so that it projects above the bench to a height equal to the thickness of the side.
- (d) Set fence the required distance to make the first cuts in the ends of the front. Make these cuts with the face side of stock against the fence.
- (e) Reset fence to make the second cut in the ends. This should leave the thickness of the tongue that is to fit the dado cut in the sides. Make this second cut with face side against fence and mill out stock between the saw cuts.
- (f) Bring crosscut saw in position and set fence to cut tongue to length on inner side of front. The sliding carriage should be used in conjunction with the fence. The length of this tongue should be equal to half the thickness of the side.
- (g) Set the fence and saw and make the dadoes in sides to fit the tongue on the inner side of the front.
- (h) Reset fence and cut dadoes for back.
- (j) Set fence and make groove for bottom in sides and front. Operations (g), (h) and (j) should be made with one setting of the saw for depth of cut. The sides should be grooved in pairs.

(To Be Contiued)

Mr. Charles Sadler, a teacher of woodwork and drawing at Altoona, Pa., has been appointed Director of Vocational Education, to succeed C. H. Hedden.

Mrs. Henrietta W. Calvin, supervisor of home economics in the Philadelphia public schools, and former home economics specialist in the Bureau of Education, has received an honorary doctor's degree for "outstanding work in home economics education and research" from the Kansas State Agricultural College.

Mr. Clarence Nault of Green Bay, Wis., has been appointed a member of the Wisconsin State Board of Vocational Education.

Miss Kate S. North of the Oklahoma A. and M. College, has been appointed state supervisor of home economics education.

NOW, ARE THERE ANY QUESTIONS?

White Marks Removed

Q. 523. I would like to find out what will remove the white marks left on a mahogany serving tray by hot coffee? I do not know if the finish is varnish, wax, or shellac.—J. E. B.

A. The chances are that your serving tray which has been marked white by hot coffee, has been finished in shellac. The trade is now putting out this class of goods in that finish, due to the cheapness and speed of quantity production.

It may help to hold a rather warm flat iron a quarter of an inch from the surface of the tray sufficiently long to warm the surface and drive off the moisture which has been absorbed by the shellac. Care must be exercised to avoid blistering the surface.

Should this be of no avail, try rubbing the panel with a felt, crude petroleum oil, and FF pumice stone or rotten stone. Rub the full face of the panel with the grain so as to produce an even tone in the rubbing. Clean off with a dry fine cloth.

Should both of these methods fail, strip the panel with varnish remover and refinish as given in past issues of this magazine for walnut.—Ralph G. Waring.

Dressing for Schoolroom Floors

Q. 526. What is the best dressing for schoolroom floors of oak and yellow pine?—H. H. R.

A. The problem of floors in school buildings is a very serious one indeed, so much so, in fact, that most cities are not permitting the use of wooden floors at all in new buildings. Where these floors are in present buildings, however, the state health department generally has a good deal to say about classrooms, especially because of the chalk dust nuisance. It is generally recommended that floors be washed with hot water and Gold Dust, or equal, during the Christmas holidays, and again at the beginning of the summer vacation. After drying, they are then given a generous mopping of Standard Oil Co. "Floor Oil", a light grade of parafine oil comparatively free from odor, and readily absorbed by the pine. This will keep down the dust, prevent grit from working into the grain of the wood, and will allow easy washing to clean wood. Allow a week or more to dry.

On new floors, I have made it a practice to treat them with two parts of boiled linseed oil and one part turpentine applied hot and allowed two weeks drying before using. In the New York State College of Forestry here at Syracuse, N. Y., I saw floors which I had treated in this manner in 1916, and which today look as clean and fresh as when the contract was completed. These floors have had a semi-annual treatment ever since; great care being taken to thoroughly clean the floors before reoiling.

I presume that the oak floors referred to are in the principal's office, in which case they can be scraped or machine-sanded; stained and filled simultaneously; dried; and either shellaced and waxed, or varnished as desired. The infrequent wear which these floors receive will permit this better finish. It will be necessary, however, for the principal to insist that the janitor does not use soap powders and hot water on such finishes or they will be ruined. Clear water with a little borax is sufficient. —Ralph G. Waring.

"White Streaks" in Walnut

Q. 528. I have made a spinet desk out of black walnut and wish to know the best stain to use for finishing. There are some white streaks in some of the boards and I wish to bring these to the color of the other boards.—S. H.

A.: It is a rather mean job to touch up the "white streaks" (sap wood) mentioned in your letter. It is for this reason that all sap is very carefully removed in solid stocks in the factory. It is often left, however, in veneer work since the contrasting colors formed in different matchings enhances the figure of the veneer.

Your only recourse now is to give the sap streaks a staining with an extra strong stain, water preferred, being very careful not to touch the heartwood. Let this stain dry, then give the entire piece a full strength stain. Dry, after which give a coat of orange shellac reduced with two volumes of denatured alcohol. This will enable you to judge your matching and in case it is off shade a trifle, by mixing orange shellac, alcohol soluble Bismarck Brown and alcohol soluble black any shade of brown tinted shellac can be produced which may be then used as shade coat to make a perfect match of heartwood and sapwood if applied carefully with a fine camel's hair or sable brush. Let dry, fill with a dark brown silex filler, dry 48 hours, and varnish as many coats as desired in order to obtain any given finish.—Ralph G. Waring.

Wood Table Top for Metal Work

Q. 533. Will you please send the necessary information for finishing a wood-top fir table for metal working, also information on wrought iron working?—H. M. A.

A. I have found the following to be a very practical and easily renewed finish for a hexagonal table, eight feet in width for mounting metal forming machines; the table being constructed of long leaf pine. There is no reason why the same finish should not work equally well on fir which is similar though softer in character. Stain the table with a black spirit soluble dye such as Johnson's No. 170 Flemish Oak. Let dry over night and then apply several coats of shellac reduced with an equal volume of stain. At least five hours should intervene between applications of shellac. This will produce a hard, fairly tough, grease and dirt proof, and above all, an easily renewed finish, since the machines may be taken off Friday afternoon, a coat of shellac applied and the table left till Monday morning before replacing the machines. I have found also that the same material can be applied to the standards of the machines and aids materially in keeping everything looking ship shape.—Ralph G. Waring.

Making a Transformer

Q. 538. Could silicon steel be used instead of stove pipe iron for the core of the transformer?—F. J. S.

A.: Yes, it would make a more efficient transformer so could be made smaller without undue heating. I suggested the stove pipe iron because of the difficulty some men would have securing the silicon.—R. O. Buck.

Q. 539. If the output is 120 volts, would it be all right to put in a resistance to bring it to about 90 volts? How much resistance would be required?

A.: Yes. I would suggest a variable resistance such as the Bradley-Ohm.—R. O. Buck.

Q. 540. How does the current used by the eliminator compare with the 60 watt lamp?

A.: The current used is very small—the exact amount would depend upon your set.—R. O. Buck.

Kitchen Cabinet Wanted

Q. 541. Can you tell me where we can secure drawings for a Kitchen Cabinet of a design similar to that shown in Farmer's Bulletin 927, U. S. Dept. of Agriculture?—A. M. B.

A: We cannot.

Can any reader of the INDUSTRIAL ARTS MAGAZINE supply drawings for a convenient kitchen cabinet?

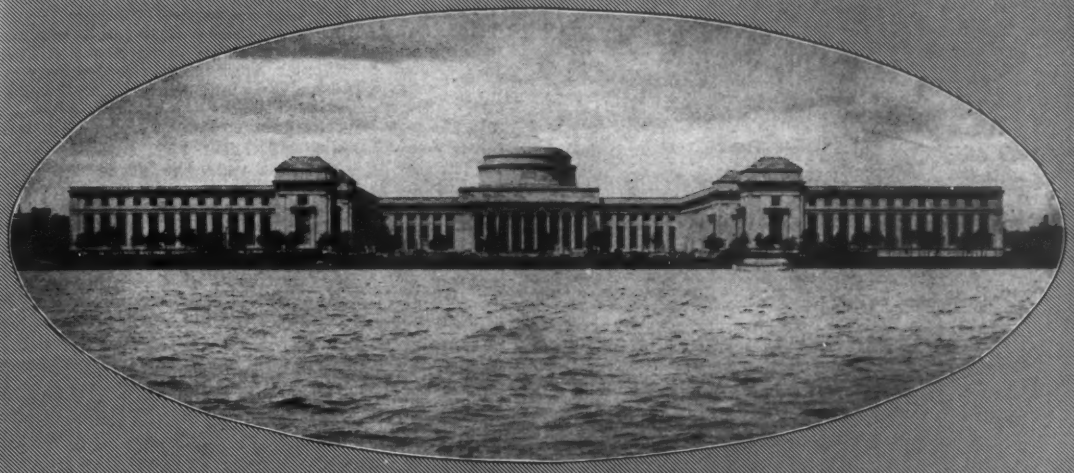
The one referred to by the inquirer is 6' 3" high to the top of the closet, 31" high to the top of the table. It is 21" deep and 48" wide. The part of the cabinet below the table contains the flour bin, large drawer, rack and dough or pastry board. Pie pans, lids, and covers have a convenient place in the rack below the drawer. The upper part of the cabinet consists of a closed compartment, three drawers, three open shelves, knife rack, and row of screw hooks for hanging utensils. A drop table 21" wide and 19" long increases the table surface.

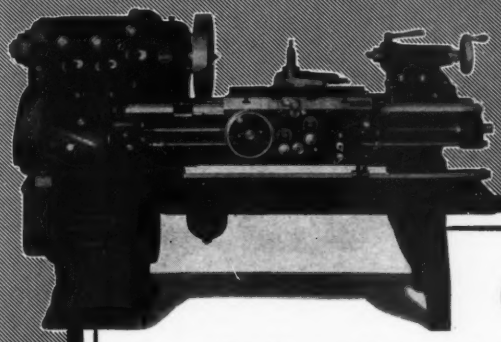
Mr. O. H. Day, formerly vocational director at Anderson, Ind., has been appointed director of vocational education and practical arts at Kansas City, Mo. For the last three years Mr. Day has been director of training work for teachers in the trades and industries at Purdue University.

Mr. S. A. Conway of Elizabethtown, Pa., has become principal of the vocational school at Boiling Springs.

Mr. Clarence D. Rotruck, instructor in the vocational department at Anderson, Ind., has been appointed vocational director of the city schools, to succeed H. W. Roberts, resigned. Mr. Rotruck came to Anderson from Akron, O., and has acted as an instructor in related subjects in the vocational department.

Mr. L. W. Fox was re-elected head of the industrial education work at the June meting of the San Antonio, Texas, school board. Press reports since that time indicate that Mr. Fox has been offered the position of director of industrial training for the Hawaiian Islands with headquarters at Honolulu. Mr. Fox has been head of the work in San Antonio since 1917. Announcement has not been made as to whether Mr. Fox has accepted the federal work or not.





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More than a quarter of a million copies of this booklet have been used as textbooks by vocational and technical schools and colleges, located all the way from Alaska to India.

Copies of the "Handbook for Drillers" will be sent in any reasonable quantities to supervisors and instructors of industrial and vocational education for use as text-books by students in machine shop practice. (No charge is made for these booklets.)

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KILN DRYING COURSES IN ARKANSAS

The lumber industry ranks first in the fast growing industrial activities of Arkansas. Lurking in the shadows of the lumber mills and manufacturing plants is a sinister foe, not so spectacular and quickly devastating as the most dreaded menace, fire, but whose depredations seriously affect the balance sheet—the stalker, Waste, eating into the profits of the lumber industry, particularly in the kiln drying of lumber.

In the spring of this year, the Trade and Industrial Section of the Division of Vocational Education, Arkansas State Board of Education, in cooperation with the Forest Products Laboratory of the United States Department of Agriculture, conducted extension courses in the kiln drying of lumber, for the lumber industries of Arkansas. These courses were the result of several years of study in regard to the service which the Division of Educational Education could render to the lumber industries.

KILN-DRYING CLASS—HARDWOOD AT PINE BLUFF, ARK.

Mr. H. C. Givens, state supervisor of trade and industrial education, presented to the membership of the Arkansas Soft Pine Association and other lumber companies, the possibilities of courses in kiln drying, and offered the services of his department, in collaboration with the Forest Products Laboratory. The offer was accepted, and courses were organized in the kiln drying of hardwoods and softwoods. The hardwood course was held at Pine Bluff, March 9 to 21. In attendance at this course were representatives of furniture factories, flooring mills, and cut-up plants.

A course in the kiln drying of pine green from the saw was conducted at Crossett March 30 to April 11. Attending this course were representatives of the Arkansas Soft Pine Association and other companies.

The development of these courses necessitated both moral and financial cooperation of the firms participating, a study by the representatives of the Forest Products Laboratory of the desirable locations in the state for conducting the courses, and the services of men and the use of equipment from the Laboratory. The courses were conducted by three kiln drying engineers, Mr. A. C. Knauss, L. V. Teesdale, and R. H. Grabow. The technical matter given in the courses was practically identical with that given in the regular courses which are conducted by the Laboratory three times a year at Madison, Wisconsin. The demonstration runs were conducted in local kilns and the degrade studies which were made were of considerable interest to the men participating.

Responses from the companies sending representatives to the courses show that the work was highly satisfactory, and the results of the training received beneficial to the kiln drying done in the plants. So favorable have been the comments made that several neighboring states are starting the organization of similar classes.—**Ellen V. Reed**, Little Rock.

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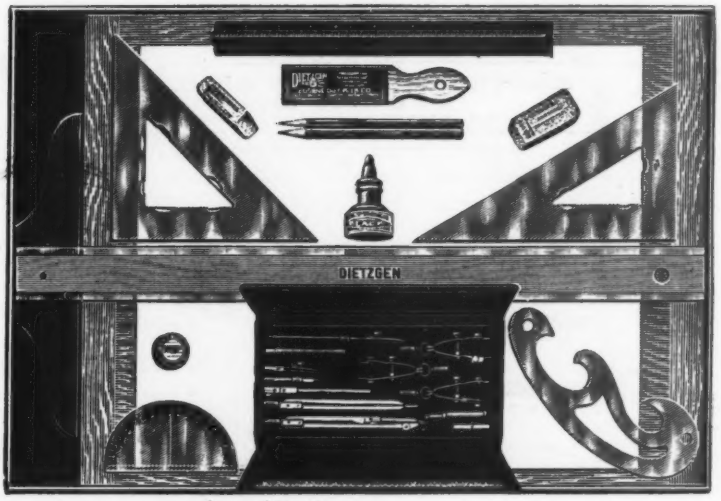

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NEWS AND NOTES

School of Trades. The corner stone of the Alabama School of Trades at East Gadsden, Ala., was laid in June. The first unit of the structure will consist of a dormitory taking care of sixty boys.

Trade Courses Established. Evidence that the industrial education program of Kentucky has been accepted is furnished by the fact that the vocational school in Louisville has been enlarged and reorganized into a trade school, that steps have been taken toward the erection of a trade school at Paducah, and by the further fact that trade classes have been opened in Providence, Somerset, Winchester, and Paducah.

It appears that the rate of growth of the trade classes has exceeded that of the growth of available funds, and it is apparent that a reduction in the per cent of air given schools must be made. There have been added this year the following trade classes:

Auto mechanics day trade class at Winchester and Providence; two carpentry day trade classes at Paducah; electric wiring day trade classes at Paducah; evening apprentice plumbing class at Louisville; evening apprentice printing class at Louisville; evening class in design for boiler makers at Somerset.

This represents the most substantial growth industrial education has made in any one year, Mr. Ryan said. Lexington and Owensboro, where the permissive mandatory part-time law has been in effect for several years, report favorably on results, he added. "Interest in this type of education has spread and it would seem reasonable to expect a greater growth in part-time education during the year 1925-1926 than we have had during all of the years past," he concluded. "Plans are to center all efforts on the development of part-time education as the day trade class seems to have reached a place where it will grow of its own accord."

The statistical data included in the report showed in Kentucky:

Nine part-time classes, 39 day trade, 5 evening, a total of 53.

Number of students, 167 part time; 546 day trade; 128 evening; a total of 841.

Number of teachers, 9 part time; 18 day trade; 4 evening; a total of 31.

Cities participating, 3 part time; 6 day trade; 3 evening; a total of 12.

Manufacture School Furniture. During the summer months the manual training department at Sioux City, Ia., has constructed school furniture valued at approximately $12,000. The cost of material and labor for this furniture was approximately $8,000, showing a net saving of about 33⅓ per cent. The work was done by a group of twenty instructors and boy workers.

Among the pieces of furniture turned out were 84 library tables, nineteen sewing tables, typewriter tables, lunchroom tables, and 70 teachers' desks.

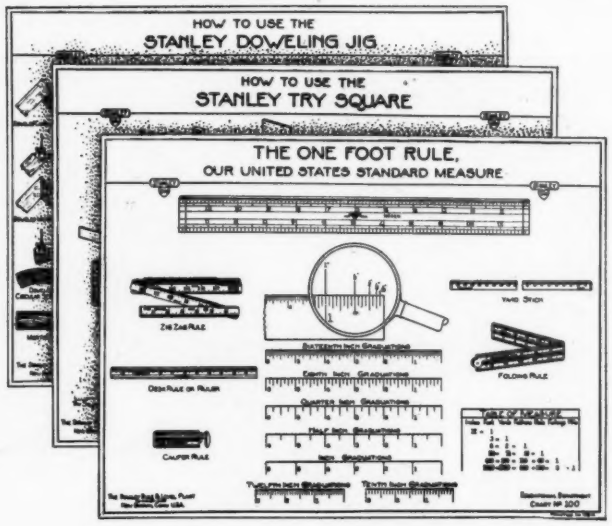
Establish Printing Course. The school board has ordered the establishment of a three-year printing course in the senior high school, Flint, Mich. An instructor will be employed on a twelve-month basis, the vacation months to be used in production work for the board.

Placement Bureau. A junior placement bureau has been planned for the next school year at Newark, N. J. Miss Rose Galaida has been named as supervisor of the placement bureau.

Scholarships for Poor Children. The Vocational Supervision League of Chicago, which has under its direction the placement of children 14 to 16 years of age, directs its efforts toward keeping such children in school, and to the work of finding the best employment available for those who must go to work.

The League takes children unskilled in vocations and endeavors to link them up with vocational opportunities. For such children as these scholarships have been provided, to be administered purely as an educational and not as a charity measure. The scholarship is a sum of money paid to the child once a month in recognition of certain qualifications, and is not given for family relief.

To obtain a scholarship, a child must be between 14 and 16 years of age; he must pass the physical examination given by the medical department of the board; he must show a desire to continue school work and his school record must be uniformly good, and finally, the financial condition of the family must be such that they cannot



Note:—There are two more in this series—Chart No. 102 on the Stanley Doweling Jig and Chart No. 101 on the Stanley Try Square.

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afford the additional expense of the child's education. The average scholarship is $15 a month, which is computed to be the actual amount of the child's expenses. The range of scholarships is from $5 to $25 a month, and an investigation of each case is made by trained social workers.

During the past year the League gave scholarship aid to 169 different children, representing 27 different nationalities. The children are in 46 different schools and the majority of them are taking high school courses.

The work of the League is supported by private subscription and the great part of its expenditure is for scholarships. A full scholarship is $200 yearly, which includes the monthly amount given the child and the overhead expense of carrying on the work.

Change Scope and Name of School. The Milwaukee School of Trades for Girls has been reorganized, and its name has been changed to the Girls' Trades and Technical High School of Milwaukee. The school will offer courses leading to three types of diplomas:

Junior High School Diplomas, including work in the 7th, 8th, and 9th grades.

Trades Diploma for work in the 9th and 10th grades, and distinctly trade courses.

Senior High School Diploma, for work in the four years of high school.

Miss Ora Blanchar is Principal.

Plan New Trade School. Beginning with the fall term, Brightmoor, Mich., will have a vocational school open during the days to the children, with evening classes for adults, according to R. A. Shaw, vice-president of the Redford Union District school board. The building to be used for this school is already built and the board has voted $12,000 to equip it properly. The aim will be to develop it along the lines followed by the Cass Technical School in Detroit.

Remodel Building. Students of the Building Trades School and of the Vocational School at Newark, N. J., are reconstructing the second floor of a building to be used as an annex to the Girls' Vocational School. The entire work of reflooring, erecting partitions, putting in doorways, and renewing the wood trim is being done by the carpentry class. The entire work of rewiring and putting in new fixtures for electric lighting is being handled by the electrical class. Furniture for the school, including tables and cabinets of special design, are being handled by vocational classes in cabinet making. The entire work is under the direction of Mr. A. G. Bennett, head of the carpentry department.

Association Disbands. The Virginia Society for Vocational Education has disbanded.

To Start New Course. Manual Training and Domestic Science Courses have been added to the high school curriculum at Fulton, N. Y. Miss Eleanor Harding will teach domestic science and Matthew Frawley will teach manual training.

Establish Course in Vocational Agriculture. Mr. Alfred A. Neff, a graduate of Purdue University, has been hired by the school board at Ney, Ohio, to teach the first department of vocational agricultural training to be opened in Defiance County. All the other counties in the northwestern section of Ohio have one or more vocational agricultural departments, and Mr. Neff will begin at once to enroll students and place laboratory equipment in the Ney High School.

Change of Name Not Granted. The faculty of the Seneca Vocational School, Buffalo, N. Y., petitioned the board of education to change the name of the school to the Electrical Vocational School. The board finally decided not to change the name.

Vocational Teachers' Conference. Ninety teachers of vocational agriculture, representing eighty-one rural high schools in North Carolina, held a two weeks' conference at the State College at Raleigh, N. C. Mr. F. M. Struck, assistant director of vocational education for Pennsylvania, gave a course of special work in farm shop practice. Mr. R. D. Maltby, federal agent for vocational education, Washington, D. C., discussed part-time educational agriculture.

Manual Training and Domestic Science Obligatory. As a result of a four to three vote of the school committee of Beverly, Mass., pupils thirteen years of age, who are in the fifth or sixth grades, are required to take manual training, if boys, and domestic science, if girls. It was brought out that these studies would prove of great advantage especially to pupils who leave school at the age of fourteen.

(Concluded on Page 30a)

Civilization's Greatest Weapon

THE-BOY-AT-THE-PRESS is in control of what is civilization's greatest weapon in its warfare on ignorance and injustice. The very books from which the boy receives instruction in all his studies are the product of the printing press, and its installation in the school he attends permits him to be instrumental in helping to educate others, while at the same time he is adding to his own knowledge.

The use of a printing press and types in a school means a greater appreciation of the correct use of punctuation points, proper paragraphing, capitalization, and division of words, as well as accurate spelling. Provide the pupil with the tools of printing; teach him beauty by means of comparison between printed products; inspire him with a desire to create harmonious effects; then guide his attempts along those lines created by experience; and you will obtain a pedagogical product that is enabled to depend on its own resources—efficient, original and industrious.

Write, giving details regarding the kind of school you hope to equip with printing, and let us send you full information regarding all details of installation. If desired, a representative of the American Type Founders Company, from its nearest Selling House, will visit you for a personal interview. The school year is well under way—write to-day.

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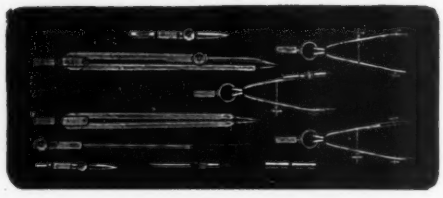

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(Concluded from Page 28a)

Plan Increase in Continuation Schools. The New York, N. Y., board of education has included funds in the next year's budget for opening two new continuation schools and establishing ninety additional teaching positions in order to take care of an expected increase of 14,000 pupils. Director of Continuation Schools, Morris E. Siegel, requested $1,977,134 for next year, as against this year's allowance of $1,224,264.

The two new schools to be organized are a Central Needle Trades Continuation School, to be located in a leased building in the garment trades center in the mid-town section of Manhattan, and a continuation school in Harlem, to be situated in a vacated public school building.

Trade Pupils Earn $100,000 in Twelve Months. Approximately $100,000 is earned annually by pupils of the Fond du Lac Vocational School, Fond du Lac, Wisconsin, according to figures compiled by Director O. J. Dorr. Of this amount about $70,000 was earned during the regular school year and the balance during the summer. During the first five months of this year an average of over one hundred boys and one hundred girls were employed, the boys earning about $1,300 per month and the girls $700.

Leather Exhibit. The Newark Museum will hold in the Fall an exhibition of leather and things made from leather. The material is being gathered by cooperation of the museum and of the various associations representing the leather and shoe manufacturers of the United States.

A conference of vocational educational leaders was recently held at Ames, Iowa, called by S. C. Sonnohsen, state director. The purpose of the conference was a closer cooperation between the state and national forces.

The total income from home farm projects of the boys enrolled last year in the vocational schools of Virginia, has netted the sum of $153,422, as demonstrated by Harris Hart, state superintendent and Dabney S. Lancaster, state supervisor.

Over a quarter of a million dollars was spent in Mississippi last year for vocational education. The money spent was received from three sources, explains F. J. Hubbard, state director; local, state and federal.

Alabama is aiming to establish an annual school of instruction for teachers in vocational agriculture. The plans are in hands of Robert E. Cammack, state supervisor of agriculture.

The second annual vocational show was held at Anderson, Indiana, in August. Guy Williams of Pendleton was in charge. Some 350 boys and girls competed for prizes.

Less Attendance Recorded. The number of students in the Land Grant Colleges, has more than doubled during the past ten years, but there has been a decrease of 3 per cent in the number of enrollments in agricultural courses.

PUBLICATIONS RECEIVED

Analysis of the Management of a Corn-Growing Enterprise. Bulletin No. 101, Agricultural Series No. 24, May, 1925, issued by the Federal Board for Vocational Education, Washington, D. C. The material in this bulletin consists of an analysis of the managerial jobs encountered in an enterprise of growing corn for grain. It is directed to vocational teachers in all types of agricultural schools, to teacher trainers, and to state supervisors for the purpose of assisting in the selection and organization of training content in the field of activity considered.

The Tattler. The June, 1925, issue of The Tattler has been issued in the form of a special art edition. The cover is carried out in seven distinct colors on the outside, and in a two-color pattern design on the inside. The text matter is illustrated with wood cuts and with actual water-color reproductions in delicate tints. The magazine is published by the McKinley Alternating School at Newark, N. J., under the direction of Miss Margaret Matlack, editor, and Mr. Frederick A. J. Braun, in charge of the typography.

Party Pointers. A school project, compiled and printed by the various classes of the Empire Junior High School, Cleveland, Ohio. The material was taken from the written composition work of an eighth grade, and from the poems submitted by pupils of the school at large. The illustrations are the products of the art classes in the Empire School, while the printing is the work of 8B classes in the printshop of the same school. The book offers a list of games and special menus for use at ordinary parties, also for use at special parties on such days as Hallowe'en, Thanksgiving, Christmas, Valentine's Day, Washington's Birthday and St. Patrick's Day.

Apprenticeship in the Building Trades in Washington, D. C. By Mary Conyngton. Reprint from the Monthly Labor Review (January, 1925) of the Bureau of Labor Statistics, U. S. Department of Labor, Washington. There is still considerable vagueness as to the actual situation in the supply of labor for the building trades. In the average city, no persistent effort has been made to improve conditions, or to discover the attitude of employers toward apprenticeship training. The present pamphlet is the result of a study conducted the past summer in Washington, D. C., and the facts revealed show a situation which is common, if not general. Among the topics treated in the report are restriction of apprenticeship by the trades, effect of restrictions upon the supply of workers, methods of recruitment, supervision and training, and reasons for the falling of the apprenticeship system into disuse.

The ELDORADO PAGE

Sketching with Dixon's Eldorado

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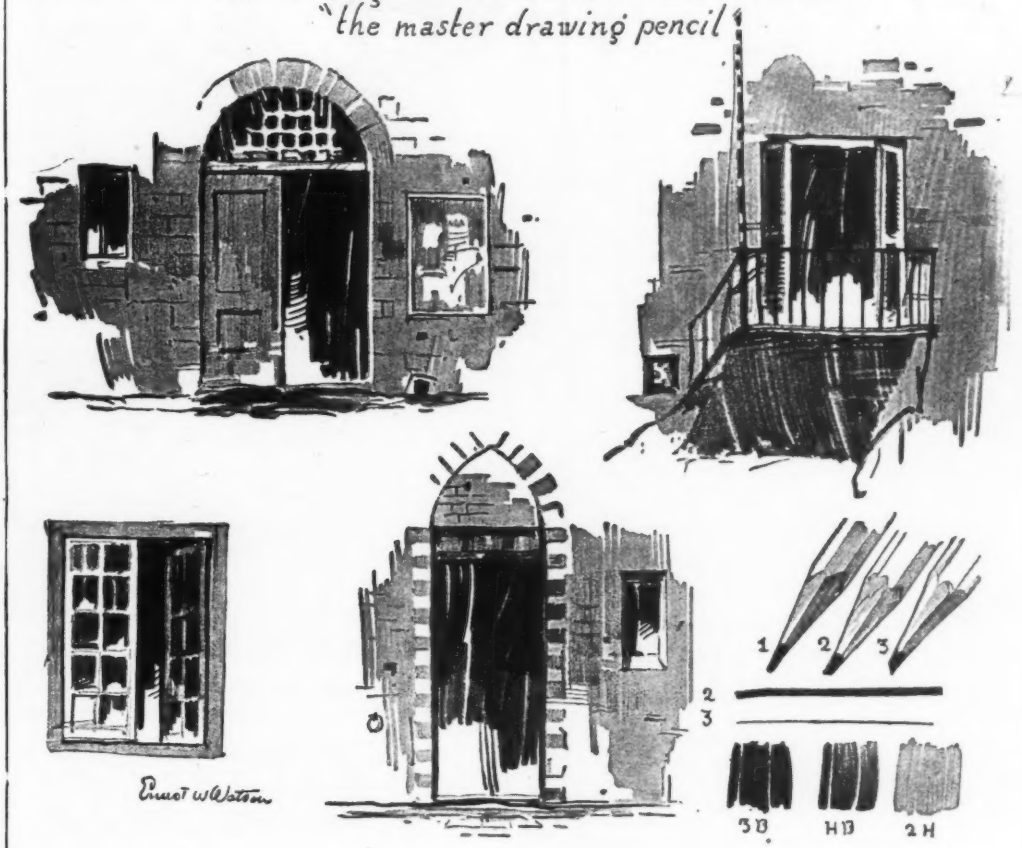

No. 1 Area Technique

BEGINNING with this page, the Joseph Dixon Crucible Company, of Jersey City, N. J., will run a series of full pages in this magazine dealing with the technique of penciling. All of these pages will be written and illustrated by Ernest W. Watson, Instructor in Pencil Sketching at Pratt Institute, and we believe that readers of "Industrial-Arts" will find them of great interest and help.

Please write to us now if you wish additional copies of this first "Eldorado" page for your files. We will also put your name on our list to receive proofs of each additional page if you want to receive them. Following are Mr. Watson's notes on "Area Technique":

Secure pictures of open doors and windows for sketches similar to those on this page.

Mass in the darkest tone first, thus giving the "pitch" or "key"—almost invariably a wise procedure. Use a soft pencil (3B Eldorado). Bear on hard. Make velvety black strokes. Swing the pencil with a swift, nervous movement for a clear-cut, snappy effect. Try different stroke groupings, changing direction and combining grays with the blacks.

The HB Eldorado will give the medium tones and the 2H Eldorado the lightest tones. Always put pressure on the pencils. If too dark a tone results, try a harder pencil.

Point pencils in this way: Sharpen as you would for writing (see illustration 1). Holding pencil in natural writing position—wear down on a scrap of paper to get broad drawing surface (2)—not a chisel edge. This will make a broad line (2). Turn pencil over (3) for a thin line (3).

Select a soft, smoothly surfaced paper without glaze. Cameo plate is excellent for those skilled enough to dispense with erasing. Try various pencil papers until you find the most responsive surface. Roughly surfaced papers demand harder pencils; smooth papers, soft pencils. Four or five sheets between drawing and board give a better result.

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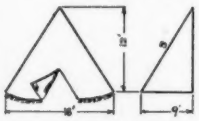
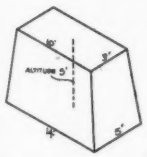
GEOMETRICAL SOLIDS—*continued*



5. How many sq. ft. of canvas are there in a tent 12′ high, the diameter of the base being 18′? The slant height has to be found to determine the lateral area. To obtain this the solution for the hypotenuse of a right angle triangle is necessary.

$s^2 = 144 + 81$
$= 225,$
$s = \sqrt{225}$
$= 15.$

Lateral area $= \frac{\pi DS}{2}$
$= \frac{3\frac{1}{7} \times 18 \times 15}{2}$
$= \frac{5940}{7} \times \frac{1}{2} = \frac{5940}{14}$
$= 424.3$ sq. ft.



6. How many cu. yds. are there in the foundation for an engine if the dimensions are as shown in the figure?

Vol. $= \frac{H}{3}(B + b + \sqrt{Bb})$,
$B = 5 \times 14 = 70$ sq. ft.,
$b = 3 \times 10 = 30$ sq. ft.,
$\sqrt{Bb} = \sqrt{70 \times 30} = \sqrt{2100} = 40.62,$
Vol. $= \frac{1}{3}(70 + 30 + 40.62)$
$= \frac{1}{3} \times 140.62$
$= 468.70$ cu. ft.

There are 27 cu. ft. in one cu. yd.

Hence, volume in cu. yds. $= \frac{468.70}{27} = 17.35.$

7. A steel ball 5″ in diameter is dropped into a cylindrical jar which is filled within an inch of the top with water. The diameter of the jar is 6″ and its height is 7″ How many cubic inches of water will overflow?

The volume of the water in the jar equals $\pi(9)(6) = 54\pi$. The inside capacity of the jar equals $\pi(9)7 = 63\pi$. $63\pi - 54\pi = 9\pi = 9 \times 3.1416 = 28.2744$ cu. in. This represents the volume of the space above the water. If this volume be subtracted from the volume of the ball, we will have the number of cu. in. of water that overflows.

Vol. of ball $= \frac{\pi D^3}{6} = \frac{3.1416 \times 125}{6} = 65.41$ cu. in.
$65.41 - 28.27 = 37.14$ cu. in.

as the amount of water overflowing.

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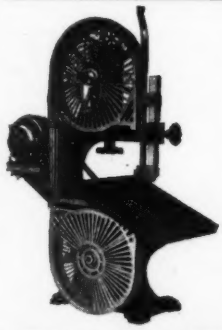

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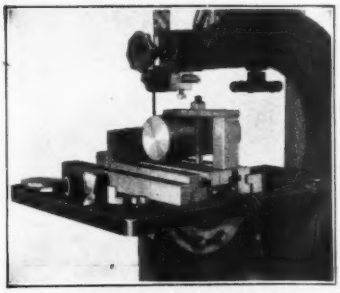

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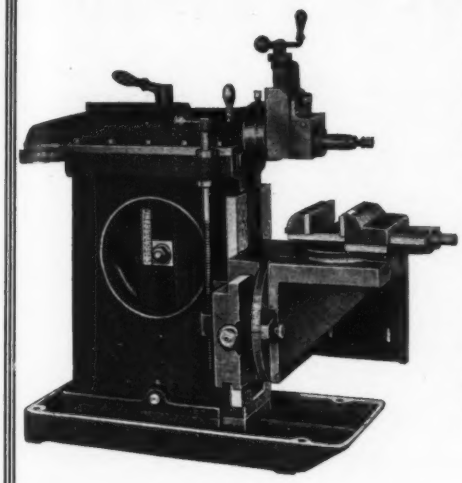

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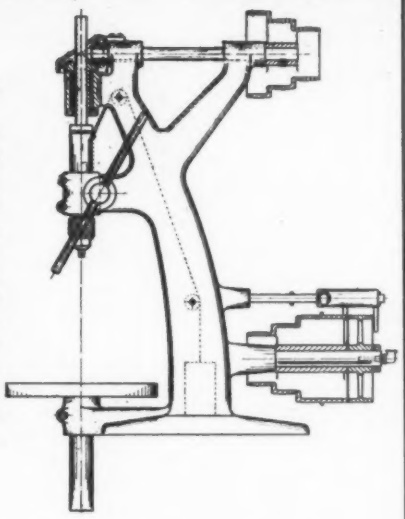

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SCHOOL BUYERS' NEWS.

Valuable Catalog for School Shops. The shop teacher who has encountered difficulty in finding a reliable source of material for completing cabinet making projects will welcome the new catalog C, of F. A. Rauch & Co., 410 South Market St., Chicago.

This catalog has been carefully compiled and fully illustrated to meet the needs, not only of the experienced buyer of furniture and upholsters' supplies, but especially of the teacher and occasional purchaser who is not so familiar with trade names and trade practice. The catalog covers an astonishing complete line of upholstery fabrics, and supplies, cabinet hardware, furniture trimmings, fine cabinet making and upholstering tools, automobile top materials and supplies, drapery hardware, wood finishing materials and brushes, etc. Teachers will appreciate special sections of the catalog devoted to furniture frames, cabinet hinges and butts, leathers, etc.

School Printing Outfits. Printing as a shop subject in the industrial arts departments of elementary and high schools and as a vocational subject in continuation and trade schools is being "sold" more intelligently to American educators and the public generally than any other subject. Printing is a peculiarly interesting trade which contains elements of culture, economic importance, and social value that no other subject possesses. It is, therefore, a school subject which deserves all the publicity that it is receiving.

Messrs. Barnhart Brothers & Spindler, Chicago, are rendering the teaching of printing a valuable and intelligent service in giving school men specific help in solving their problems of administration and practical shop management. The educational department of the firm is always ready to offer help in discussing a course of study, in criticizing constructively the products of the school shop, and in helping teachers in other ways.

Recently the firm has broadened its service by offering the school authorities and architects help in planning the layout of school shops and in selecting equipment and materials for printing courses. Tangible evidence of this service is contained in a new portfolio entitled "Superior School Printing Outfits" which contains a series of blueprints of school print shops especially adapted to typical courses and standard sizes of classes. Not only is the location of type cases, presses, stones, etc., given in detail, but suggestions are made for selections of type and other accessories, with complete cost lists, etc. The portfolio includes also complete suggestions for school bindery outfits where the elements of book binding and pamphlet binding may be taught. Interested teachers and supervisors will find this portfolio a most useful addition to their professional libraries.

Evolution of the Plane. A considerable amount of most valuable teaching information for use in shops and shop classes has been contributed to schools by American manufacturers. In fact, the ordinary professional literature and the textbooks used in trade schools contain comparatively little material on the tools of the several trades because the manufacturers have been so generous in supplying technically correct and complete material arranged for teaching purposes.

One of the latest and most interesting contributions to the literature on tools of the woodworking trades is an eight-page "letter" entitled "Evolution of the Plane," prepared and issued by the Stanley Rule and Level Plant of The Stanley Works at New Britain, Conn.

This "letter" illustrates and describes in detail the evolution of the plane from the earliest recorded history of the Egyptians and Phoenicians through ancient and medieval times down to the present day. Particularly interesting and useful is the section devoted to the development of the Stanley Bailey plane which is widely used in American industry and is a favorite in school shops. The "letter" will be sent on request to any teacher.

SUCCESSFUL SUMMER COURSES

The summer course for Continuation and Vocational School teachers was conducted by the Vocational Division, Massachusetts Department of Education, at the Fitchburg Normal School, from July 6 to 31, inclusive, under the direction of M. Norcross Stratton, Coordinating Agent for Teacher-Training and Supervision, assisted by Miss Anna A. Kloss, Agent for Teacher-Training in Household Arts Schools.

Courses were offered for academic teachers in vocational schools; shop and academic teachers in continuation schools, teachers in day household arts and evening practical art schools.

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M. Norcross Stratton, Massachusetts Department of Education, in charge.
Miss Anna A. Kloss, Massachusetts Department of Education.
Miss Edith M. Thomas, Federal Board for Vocational Education.
Miss Anna G. Gorman, Massachusetts Department of Education.
Miss Edna M. Sturtevant, Massachusetts Department of Education.
Miss Caroline E. Nourse, Massachusetts Department of Education.
Daniel H. Shay, Massachusetts Department of Education.
John I. Lusk, Massachusetts Department of Education.
Frederick A. Coates, Massachusetts Department of Education.
Carl E. Herrick, Massachusetts Department of Education.
Edward T. N. Sadler, New Bedford Continuation School.
Miss Alva B. Glidden, New Bedford Vocational School.
Mrs. Edna P. Bryte, David Hale Fanning Trade School for Girls—Worcester.
Miss Regina M. Wholley, Boston Evening Practical Art School.
Miss Josephine S. Louette, Fall River Evening Practical Art Classes.
Miss Mildred G. Horne, New Bedford Vocational School.
Mrs. Margaret Ells, Springfield Continuation School.
Willis B. Anthony, Fitchburg Normal School.
Charles E. Akeley, Fitchburg Normal School.
C. Blair MacLean, Fitchburg Normal School.
Frank S. Livermore, Fitchburg Normal School.
Clark B. Morrill, Fitchburg Normal School.
Lawrence E. Landahl, Fitchburg Normal School.
Margaret M. Broderick, Secretary.
Edward Callahan, Clerk.

In addition to the faculty assembly lectures and special conference talks were given by the following:
J. C. Wright, Director, Federal Board for Vocational Education.
Miss Florence A. Somers, Massachusetts Department of Education.
Dr. Mary Lakeman, Massachusetts Department of Health.
Dr. Henry B. Elkind, Massachusetts Department of Mental Hygiene.
Dr. John M. Brewer, Harvard University.
John J. Boyan, Boston Continuation School.
Mrs. Mary T. Coleman, Brockton Continuation School.
Miss Clover G. Knowlton, Worcester Continuation School.
Carl F. Schrader, Massachusetts Department of Education.
Arthur P. Whipple, New Bedford Vocational School.
Arthur L. MacRae, Cambridge Continuation School.
Roland B. Houston, Clinton Continuation School.
Thomas A. Carey, Worcester Boys' Trade School.
John D. Cooney, Worcester Boys' Trade School.
Leroy M. Twichell, Malden Continuation School.

There were 205 men and women teachers enrolled for the course.

A special publication called "Conference Notes" was published weekly by the members of the printing department and edited by Mr. Frederick A. Coates of the Massachusetts Department of Education.